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Global Environment Facility

China Contaminated Site Management Project

Environmental Assessment Report for Cleanup of Ganshui Agricultural Material Warehouse Site in Qijiang District of Chongqing Municipality

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1. Background

1.1. Compliance Background of POPs in China

Persistent Organic Pollutants (POPs) refer to persistent, bio-accumulative, highly toxic organic pollutants with long-distance transport properties. Once entering into the nature, POPs can remain in the environment persistently, accumulate in organisms, reach medium toxic concentration via biological magnification of food chain, and achieve the concentration levels enough to cause serious adverse effects in the atmosphere, water, soil and other environmental media. Meanwhile, POPs may migrate to places far from pollution sources along with air and water flow, and even settle at the remote polar regions of the earth, thus causing global pollutions. POPs accumulating to a certain concentration will cause harm to organisms, resulting in allergies, hypersensitization, damage of central nervous and peripheral nervous system, genital system and immune system, interfere internal secretion and cause teratogenic, carcinogenic and mutagenic effects. The pollution it causes is deemed as one of the global issues with significant environmental risks by international agencies.

Stockholm Convention on Persistent Organic Pollutants (POPs convention) involves for the first time 12 types of substances such as DDTs, chlorodane, PCBs, dioxin and other substances under control. Among them, there are 9 types of organochlorine pesticides, i.e. aldrin, dieldrin, endrin, DDTs, HCBs, heptachlor, chlordane, mirex and toxaphene, etc. Besides aldrin, dieldrin and endrin, other 6 types of pesticides like DDTs, toxaphene, BHCs, chlordane, mirex and heptachlor are produced and put to use in China. Article 6 of the Convention requires contracting parties to identify possible POPs contaminated sites, and encourages environmentally sound methods to manage or repair them.

China's preliminary investigations into domestic POPs manufacturers during the preparation process of National Implementation Plan of China for fulfillment of the Stockholm Convention on Persistent Organic Pollutants (hereinafter referred to as National Implementation Plan) have shown that:

- Most of the POPs manufacturers in China were established in the 1960s and 1970s, featuring in poor manufacturing facilities, backward processes and shortage of pollution control facilities. The "waste gas, wastewater and solid wastes" discharged during manufacturing process have caused severe pollution to the surrounding environment.
- Since China developed pesticide registration system in 1982, manufacture and use of pesticides like toxaphene, heptachlor, DDTs, HCBs, chlordane and mirex etc. has been prohibited.
- After manufacture of some of the POPs chemicals was banned in the 1980s, most manufacturers did not clean up their manufacturing facilities and sites and few companies simply dumped or buried sorted-out poisonous and harmful wastes inside or outside their factory, and most of the dumping sites and landfill sites took no protective measures and serious environmental safety hazards ensued.

In order to effectively prevent such environmental risks, National Implementation Plan clearly proposes to set up a regulatory system for environmentally sound management of POPs contaminated sites and launch identification and risk assessments for these POPs contaminated sites.

1.2. Project Overview

In order to implement the requirements in the National Implementation Plan, control and gradually eliminate environmental safety hazards of POPs contaminated sites while protecting environment and human health, Foreign Economic Cooperation Office of Ministry of Environmental Protection of the People's Republic of China (hereinafter referred to as FECO) and the World Bank jointly initiated "Chinese Contaminated Site Management Project" of the

Global Environment Facility. The Project, with a total fund of 75 million U.S. dollars (including 15 million U.S. dollars of grants and 60 million U.S. dollars of domestic supporting funds), aims to build and improve the policy rules and regulations for management of contaminated sites, and carry out identification and risk assessments of POPs and/or other hazardous chemicals contaminated sites as well as technical and managerial demonstrations of remediation projects.

The Project consists of three major parts: (1) Policy improvement and capacity building; (2) Repair demonstrations of typical POPs contaminated sites; (3) Project management.

In November 2013, investigation groups from the World Bank confirmed Ganshui warehouse in Qijiang District of Chongqing as Component 2 of this project, one of the pilot projects for site remediation in “clean-up of POPs contaminated site” (hereinafter referred to as Ganshui site), which had established a complete management system through a series of remediation activities such as site investigations, risk assessments and remediation demonstrations, etc. while providing technical guidance and managerial reference for remediation of the sites contaminated with POPs and other hazardous chemicals in China.

1.3. Scope of Environmental Assessment

The scope of environmental assessment includes Ganshui warehouse and its surrounding environmental sensitive points, covering a land area of about 667 m^2, among which the pesticide storage room occupies about 50 m^2.

1.4. Implementing Agencies of Environmental Assessment

According to different tasks of Ganshui site remediation sub-projects, agencies involved in environmental assessment are as follows:

(1) Beijing Academy of Environmental Sciences

Beijing Academy of Environmental Sciences is responsible for preparing environmental impact assessment reports for typical pesticide warehouse sites in Qijiang District of Chongqing. Beijing Academy of Environmental Sciences (hereinafter referred to as “the Academy”) is the first scientific research institution involved in environmental sciences in China. It has first-grade qualification certificate of environmental impact assessment for national construction projects, first-grade qualification for operations of environmental pollution control facilities (domestic sewage and industrial wastewater), first-grade qualification certificate for engineering consultation issued by National Development and Reform Commission, first-grade qualification for professional design of municipal drainage works, first-grade qualification for professional design of special environmental projects (water pollution control projects), and grade-B qualification for design of solid waste disposal projects. So far, the Academy has completed over 900 projects on research of environmental sciences and technologies, over 1,500 treatment projects in nearly 30 provinces (cities) and autonomous regions of China (including Hong Kong), and over 3,500 environmental assessment projects.

(2) Chongqing Solid Waste Management Center

Chongqing Solid Waste Management Center, established in November 2004 after being authorized by Chongqing Municipal Commission for Public Sector Reform, is a division-level unit directly subordinate to Chongqing Municipal Environmental Protection Bureau. It includes solid waste management section, technology and chemical management section and contaminated site management section. Its main responsibilities are: provide technical support for management of solid waste and chemicals, prepare the files and build databases for solid waste management; assist in management for transfer, exchange, disposal and other activities of solid water and hazardous wastes; assist in management of operations for hazardous (medical) waste disposal units and facilities; participate in highly professional tasks of examination and authorization for business licenses and imports and exports of hazardous wastes; help handle emergency accidents of hazardous wastes and chemical pollution, and provide with training programs on management of solid wastes.

(3) Chongqing University of Technology

Chongqing University of Technology was formerly known as No. 11 Technical Training School of Bureau of Ordnance of the national government established in 1940. In 2009, it was renamed as Chongqing University of Technology as authorized by the Ministry of Education. Now, it has 1,561 staff, including 3 national candidates for “New Century Talents Project”, 14 winners of special government allowances provided by the State Council, 13 persons as the academic and technological leaders of Chongqing, 3 young and middle aged experts with outstanding contributions in Chongqing, and over 60 excellent young and middle aged backbone teachers at colleges and universities of Chongqing and other provincial and division-level talents. It has 641 senior professional technicians and nearly 1,000 with master and doctor degrees.

(4) Chongqing Solid Waste Management Service Center

Chongqing Solid Waste Management Service Center is, established in January 2002 upon approval of Chongqing Municipal Environmental Protection Bureau and affiliated to Chongqing Municipal Solid Waste Management Center, one of the members of solid waste management commission of Chinese Society for Environmental Sciences and a standing member of Chongqing Municipal Association of Environmental Protection Industry. It provides technical support for solid waste environmental management and remediation of chemical contaminated sites critical for environmental safety in Chongqing, and is also specialized in environmental consultation services, involving disposal and technical consultation of solid waste and hazardous waste, design and construction of solid waste disposal site, environmental impact assessment; auditing of cleaner production; environmental protection planning; solid waste pollution control and comprehensive utilization; feasibility study of projects; environmental risk assessment and treatment of soil, and so on. The Center has powerful technical force, and has obtained hazardous waste business license in Chongqing, first-grade qualification certificate for environmental pollution control, qualification certificate for environmental impact assessment of construction projects and cleaner production examination in Chongqing.

(5) SGS-CSTC Standards Technical Services Co., Ltd. (Shanghai)

SGS-CSTC Standards Technical Services Co., Ltd. (Shanghai) is a joint venture established by SGS Group and China Standard Technology Development Corporation affiliated to the former State Bureau of Quality Technical Supervision in 1991. The company has 50 branches or more and dozens of laboratories in China, including textile, chemical, environmental, light industrial product, electronic and electrical safety/electromagnetic compatibility, metallic materials/high polymer materials, and wireless communication laboratories and nearly 8,000 well-trained experts. It has possessed a sound quality assurance system and obtained certificates of CMA, CNAS, UKAS, CBTL, ISO9001 and ISTA, etc.

1.5. Implementation Process of Environmental Assessment

Although the remediation project focuses on mitigation and elimination of environmental pollution, implementation of contaminated site remediation will have a certain impact on surrounding environment, human health, social life and so on. Based on the World Bank’s environmental assessment policy (OP4.01) and China’s laws and regulations on environmental impact assessment, Ganshui site had carried out environmental assessment with its implementation process as follows:

(1) In December 2012, Chongqing University of Technology conducted the first stage of site investigations, and confirmed the status quo of the site, surrounding environment, owner of the site, planning of future land use, history of site use, potential environmental pollution and so on;

(2) In December 2012, Chongqing University of Technology conducted the second stage of site investigations, analyzed samples of the soil taken from the contaminated site and determined target pollutants of the site preliminarily;

(3) Upon the approval of the project concept in September 2013, Beijing Municipal Research Institute of Environmental Protection screened potential environmental and social impacts that site remediation may cause. According to contaminated site screening table of the World Bank, the Institute confirmed that the remediation of Ganshui site fell within Category A projects, i.e., it may cause significant impacts on environment. These impacts are sensitive, diverse or unprecedented, which may affect regions far more extensive than these sites or facilities themselves may do.

(4) In December 2013, Chongqing Solid Waste Management Service Center conducted supplementary sampling investigations and further confirmed the contamination depth and range based on the results of the site investigations (site sampling and questionnaire) carried out in Chongqing at earlier stages.

(5) In March 2014, Chongqing Solid Waste Management Service Center conducted environmental health risk assessment and determined the target pollutant, target value and scope of remediation according to investigations of three phases and the test results of the site soil samples.

(6) In April 2014, Chongqing Solid Waste Management Service Center drafted the technical plan for remediation of contaminated sites.

(7) From January to July 2014, Beijing Municipal Research Institute of Environmental Protection worked out a complete preliminary draft of environmental assessment report of the site.

(8) On July 11, 2014, Chongqing Municipal Environmental Protection Bureau made a public announcement of Environmental Assessment Report of Ganshui Site (Preliminary Draft) at http://113.204.96.35:7890. Next day, *Chongqing Evening News* published news on environmental assessment report of Ganshui.

(9) On July 12, 2014, Chongqing Municipal Environmental Protection Bureau held a public meeting of Ganshui Site Treatment Project. Beijing Municipal Research Institute of Environmental Protection participated in the meeting. The revised environmental assessment report has been re-published on Oct. 15, 2014.

2. Policies, Legal and Regulatory Framework

2.1. Four International Conventions Related to Management of Chemicals

Chemical pollution of environment will not be hindered by national borders, therefore an effective international or regional management framework is proposed in the multilateral environmental agreement so as to prevent and minimize the global impact of toxic chemicals and hazardous wastes.

Four international multilateral environmental agreements (Basel, Rotterdam, Stockholm Convention and Montreal Protocol) are involved in issues of toxic chemicals in the international trade, hazardous wastes transfer, reducing and even eventually eliminating the discharge, use and manufacture of POPs, rebuilding abandoned storage sites via environmentally sound methods and identify contaminated sites, etc. The most important thing is that the four agreements help prevent future issues, vigorously promote information exchange and technical capacity building and provide financial support for developing countries and those in transition.

These four agreements provide a basic tool for regional environmental cooperation, integrating all signatory countries through international channels and solving international and regional environmental issues by means of remediation, mitigation or others, which lay emphasis on effectively utilizing shared resources - information, capital and expertise, reduce duplication, emphasize the consistency between plan and policy and avoid being fragmented.

The fundamental purpose of various conventions on chemicals and hazardous wastes is to protect human health and environment free from pollution of chemicals and hazardous wastes. Basel Convention covers a wide range of hazardous wastes, including cross-boundary transfer of chemical wastes. The Convention aims to advocate the reduction of production and harmful characteristics of wastes while making every effort to deal with the treatment and disposal of hazardous wastes close to their sources, thus controlling the transfer and transportation of the wastes to a minimum level. Rotterdam Convention is specifically designed for some harmful pesticide agents in the international trade. Stockholm Convention focuses on reducing and eventually eliminating the discharge of POPs caused by international manufacture, unintentional production, storage and wastes. Rotterdam Convention and Stockholm Convention allow the inclusion of new chemicals and Montreal Protocol aims to protect ozone layer by phasing out ozone-depleting substances.

2.2. Related Laws, Regulations and Policies

(1) National laws and regulations

Environmental Protection Law of the People's Republic of China (2014): Article 32 “China will strengthen its protection for air, water, soil and so on, establish and improve related systems for investigations, monitoring, evaluation and remediation.” Article 42 “The enterprises and other manufacturers discharging pollutants shall take measures to prevent and control the environmental pollution and hazards caused by waste gas, waste water, waste residues, medical wastes, dusts, foul gas, radioactive substances as well as noise, vibration, optical radiation, electromagnetic radiation, etc. generated from production, construction and other activities. The enterprises discharging pollutants shall establish an environmental protection responsibility system and define the responsibilities of the person in charge of the enterprise and the personnel related”.

Environmental Impact Assessment Law of the People's Republic of China (2002): Article 16 “China adopts classified management for environmental impact assessment of construction projects based on their extents of impact on the environment. (i) Where significant environmental impact may be caused, the environmental impact report shall be compiled to fully evaluate the environmental impact. Article 25 “Where the environmental impact assessment documents of a construction project has not been examined by the competent authority defined in applicable laws or fails to pass the examination, the authority in charge of examination and approval of the project shall not approve and make it eligible for construction, and the construction unit may not commence”. Article 26 “For the construction project, the construction unit shall fulfill the actions for environmental protection raised in the examination and approval comments by the competent authority responsible for examination and approval of the environmental impact assessment report, environmental impact report form and environmental impact assessment documents”.

Law of the People’s Republic of China on the Prevention and Control of Environmental Pollution by Solid Wastes (Order of the President of the People's Republic of China, No. 31, 2004): Article 5 “As for control of solid waste pollution, the unit causing pollution shall undertake the responsibilities in accordance with the applicable laws”. Article 10 “The competent administrative authority for environmental protection of the state council is responsible for unified supervision and management of solid waste pollution control in China”. Article 13 “Environmental impact assessment shall be made for projects generating solid wastes and those of solid waste storage, utilization and disposal, and the regulations on environmental protection management for the construction projects of China shall also be observed.” Article 17 “Any entity and individual engaged in collection, storage, transportation, utilization and disposal of solid wastes shall take proper actions to avoid scattering, loss, leakage and others for environmental pollution control. Random dumping, piling, discarding or spreading of solid wastes is forbidden”.

Labor and Social Security Law of the People's Republic of China: It covers regulations on social risks, right of survival, right of social security, employment right of the citizens, wherein, Item 4 defines the right of obtaining labor safety and health protection, Item 5 defines the right of accepting occupational skill training. The basic life safeguard regulations covers pension protection, health protection, unemployment security, industrial injury insurance, housing security, subsistence allowances, protection for special group, and so on.

Labor Contract Law of the People's Republic of China (Order of the President of the People's Republic of China, No. 65, 2007): Article 4 “The employer shall formulate and improve regulations on labors according to the applicable laws, and ensure the laborers enjoy the rights of work and execute the obligation of working”. Article 8 “When recruiting laborers, the employer shall truly tell the laborers the working contents, conditions, location, occupational hazards, conditions of safety production, labor remuneration and other conditions that the laborers require to know. The employer is entitled to know the basic conditions of the laborer directly related to the labor contract, and the laborer shall explain according to the facts”.

Regulations for Collection and Demolition Compensation of the People’s Republic of China (interim, 2011): It defines the working procedure, compensation indexes and calculation method for land acquisition under different conditions.

In the annex of the National Hazardous Waste Inventory (2008), the sludge of wastewater treatment (263-011-04) as well as the expired and discarded raw materials or drugs (263-012 -04) during the pesticide production are listed as hazardous wastes.

(2) Policies and notices issued by competent authorities of the State and Chongqing

One of the detailed controlled targets of National Implementation Plan of China for the Implementation of the Stockholm Convention on Persistent Organic Pollutants (2007) is to eliminate the pesticide POPs while at the same time developing the remediation of POPs contaminated sites.

The Notice jointly issued by the Ministry of Environmental Protection, the National Development and Reform Commission and other 10 related management authorities (No. 23, 2009): (1) “Production, transfer, use, import and export of DDTs, chlordane, mirex, and HCBs has been forbidden within the territory of the People's Republic of China since published. Issues on production and use of DDTs for prevention and control of vectors in emergency conditions shall be handled by relevant competent authorities”.

Measures on Management of Soil Environment in Contaminated Sites (draft): It definitely specifies the applicable scope, including “change of land use mode or ownership of contaminated sites, supervision and management of environmental investigations, assessments, treatments and remediation for land in the site”;

Circular on Environmental Pollution Control during Relocation of Enterprises (GHB (2004) No. 47): “For the already developed and being developed industrial area for relocation, formulate plans for soil environment investigations, exploration and monitoring, investigate the pollution sources within construction region, determine the work plans of site cleaning and the implementation plan for function recovery of soil, and eliminate environmental pollution of soil as soon as possible”;

Circular on Guaranteeing Environmental Safety for Redevelopment and Utilization of Sites of Industrial Enterprises (HF [2012] No. 40) further requires to: “investigate the contaminated sites, reasonably plan the use of contaminated sites, strictly control land transactions of contaminated sites, strictly manage environmental risk assessment and remediation, control land transaction of contaminated sites, and effectively avoid site contamination”.

Circular for Intensifying Treatment and Remediation of Contaminated Sites at the Original Locations of Industrial Enterprises in Chongqing City (YBF (2008) No. 208) defines to deal with contamination concerns of the original locations of industrial enterprises in Chongqing City, reduce the risks of re-utilization of land at the original location against the human health (especially for residential land) and require the responsible parties to complete treatment and remediation for the contamination sites. Construction Plan of Ganshui Town of Qijiang County defines the future use of land of Ganshui warehouse.

(3) Relevant technical guidelines and standards

Relevant technical guidelines and standards of domestic contaminated sites are shown in Table 1, which involve the management standards for contaminated sites of BHC and arsenic.

Table 1 Relevant Technical Guideline and Standards

Name of relevant technical guidelines and standards	Contents of relevant technical guidelines and standards
Environmental Quality Standards for Surface Water (GB/T 14848-1993)	The total BHCs content of Class I ground water doesn't exceed 0.005 μg/L; that of Class II not exceed 0.05 μg/L; that of Class III and IV not exceed 5.0 μg/L; and that of Class V exceeds 5.0 μg/L.
Environmental Quality Standards for Soil (revision) (Draft for comments, 2008)	The total BHCs contents for secondary standard of soil environment quality are 1.0 mg/kg, 4.0 mg/kg and 4.0 mg/kg respectively in the residential land, commercial land and industrial land.
Technical Specification for Soil Environmental Monitoring (HJ/T166-2004)	It includes location arrangement, collection, treatment and testing of samples, environmental quality assessment, quality assurance and the appendix, covering the procedures and technical requirements for soil monitoring. Gas chromatograph is designated for monitoring of BHCs and DDTs. For the detailed methods, see GB/T 14550-2003 Soil Quality - Determination of BHCs and DDTs - Gas chromatography.
Technical Guidelines for Environmental Site Investigations (HJ 25.1- 2014)	It covers information collection, site survey, sampling location arrangement and others during investigations of contaminated sites;
Technical Guidelines for Environmental Site Monitoring (HJ 25.2- 2014)	It defines contents of environmental monitoring, sample collection, monitoring method and quality control for site investigations
Technical Directive for Risk Evaluation of Contaminated Site (HJ 25.3- 2014)	It defines the principles, contents, procedures, methods and technical requirements for human health risk evaluation of contaminated sites, and the methods for determination of risk control value of soil and ground water.
Screening Levels for Soil Environmental Risk Assessment of Sites (DB11/T811-2011)	According to the soil environment risk assessment of contaminated site, it stipulates the screening levels and applicable regulations for environment risk assessment of soil pollutants under different land use types, such as residential area, park green land, industrial/commercial land, etc., of which α-BHC has the soil screening levels of 0.2 mg/kg, 0.2 mg/kg and 0.3 mg/kg respectively in the residential area, park green land, industrial/commercial land, β-BHC has the soil screening levels of 2 mg/kg, 0.2 mg/kg and 0.7 mg/kg respectively in the residential area, park green land, industrial/commercial land, δ-BHC has the soil screening levels of 2 mg/kg, 2 mg/kg and 3 mg/kg respectively in the residential area, park green land, industrial/commercial land, and γ-BHC has the soil screening levels of 0.3 mg/kg, 0.4 mg/kg and 3 mg/kg respectively in the residential area, park green land, industrial/commercial land.
Technical Guidelines for Site Soil Remediation (HJ 25.4- 2014)	It defines the basic principles, procedures, contents and technical requirements for preparation of technical scheme for soil remediation of contaminated sites.
Technical Guide for Environmental Risk Assessment of Site Contamination of Chongqing City (Chongqing Municipal Environmental Protection Bureau 2010), and Technical Guide for Supervision and Validation Inspections of Contaminated Soil Remediation of Relocated Enterprises of Chongqing City (Chongqing Municipal Environmental Protection Bureau 2013).	It determines the technical guarantee system followed in the remediation of contaminated sites in Chongqing.

2.3. Safety guarantee policies of the World Bank [1]

Safety guarantee policies of the World Bank involved in this project include:

(1) Environmental Assessment (OP/BP 4.01)

In the business policy of the World Bank - Environmental Assessment (OP/BP4.01), it is required to conduct environmental impact analysis for the renovation project of contaminated sites, and propose the control and mitigation measures in terms of environment, health and safety; in OP/BP4.01, it is also required to make public consultation and information disclosure for the relevant information (such as environment impact assessment report, remediation engineering bidding information and remediation engineering validation result assessment, etc.) during the environmental assessment and clearing of contaminated sites.

(2) EHS (environment, health and safety) Guidelines

EHS guidelines is applicable to the general and specific cases in the Good International Industry Practice (GIIP), and its reflection in the section of environment management plan of EA report can play a role of protecting human health and environment. If the local policies differ from EHS guidelines, the higher standard between them will prevail in project implementation. The applicable less strict alternative requirements and measures may also be adopted in the specific conditions of the project, under the premise that comprehensive and careful evaluation has been made. EHS guidelines of the World Bank include the following aspects:

- Common EHS guidelines: 1.5 Hazardous Material Management, 1.6 Waste Management, 1.8 Contaminated Land, 2. Occupational Health and Safety, 3. Community Health and Safety.
- Specific industry guidelines: EHS guidelines of wastes management facilities.

(3) Involuntary Immigration (OP/BP 4.12)

If no mitigation measure has been taken for involuntary resettlement during project implementation, very large risks will be incurred to the economy, society and environment, e.g. dismantling of production system, loss of property and income source, inapplicability of original living skills or increased competition in the new environment, weakening of community and social systems, separation of family members and relatives, weakening or extinction of cultural homogeneity, tradition maintaining and mutual help potential. Guarantee measures will be included in the involuntary resettlement policies for mitigating the risks of causing poverty.

Certain social impacts may be caused to the neighboring residents and communities by the contaminated site remediation project. Hence, social investigations are also required for environmental assessment of a specific site. A simple resettlement action plan shall be prepared for the influenced groups at the site.

2.4. Project Management Organization

The World Bank is the international executive agency of this project, and the FECO is the domestic executive agency. In order to ensure participation of the related parties, the National Leading Group (NLG) for POPs, which was established in September of 2003, will be responsible for overall guidance and coordination of the project. FECO will regularly organize NLG meetings to report and collect the comments on project implementation.

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[1] For more details about the WB safeguard policies and the WBG EHS guidelines, visit the Bank website: http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTSAFEPOL/0,,menuPK:584441~pagePK:64168427~piPK:64168435~theSitePK:584435,00.html and http://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/IFC+Sustainability/Sustainability+Framework/Environmental,+Health,+and+Safety+Guidelines/

In March 2014, Chongqing City and Liaoning Province were selected as two of demonstration province and city in this project. The Chongqing Project Office and Liaoning Project Office under Chongqing Municipal Environmental Protection Bureau and Liaoning Environmental Protection Department will take charge of the specific execution and management of activities within the demonstration province and city in this project.

Chongqing Project Office will, based on this environmental assessment report, be responsible for implementing and managing the remediation work of Ganshui site.

3. Site Environmental Investigations

3.1. Purposes

By means of information acquisition, archive inquiry, public investigations and field investigations of Ganshui site, understand the history of site use, type of stored pesticides and the pesticide leakage and residual phenomena; make clear its contaminated areas, determine the contaminant types, concentration (degree) and spatial distribution and develop the sampling and risk evaluation technical programs.

3.2. Scope

The environmental investigation scope focuses on Ganshui warehouse and its surrounding environmental sensitive points, covering a land area of about 667 m^2, in particularly the pesticide storeroom (50 m^2).

3.3. Site Environmental Investigation Method

Develop site environmental investigations according to the requirements of Technical Guidelines for Site environmental survey (HJ25.1-2014).

3.4. Phase-I Site Environmental Investigations

3.4.1. Geographical Overview

(1) Geographic location

The State Council approved and agreed to turn Wansheng District and Qijiang County into Qijiang District in Chongqing on October 27, 2011. The adjusted Qijiang District is located in the south of Chongqing and covers the geographical coordinates of 106º23´-107º03´E and 28º27´-29º11´N. To the east, it connects with Nanchuan District, to the south, it connects Tongzi County and Xishui County in Guizhou, to the west, adjacent to Jiangjin District and to the north, and bordered with Banan District (as shown in Figure 1).

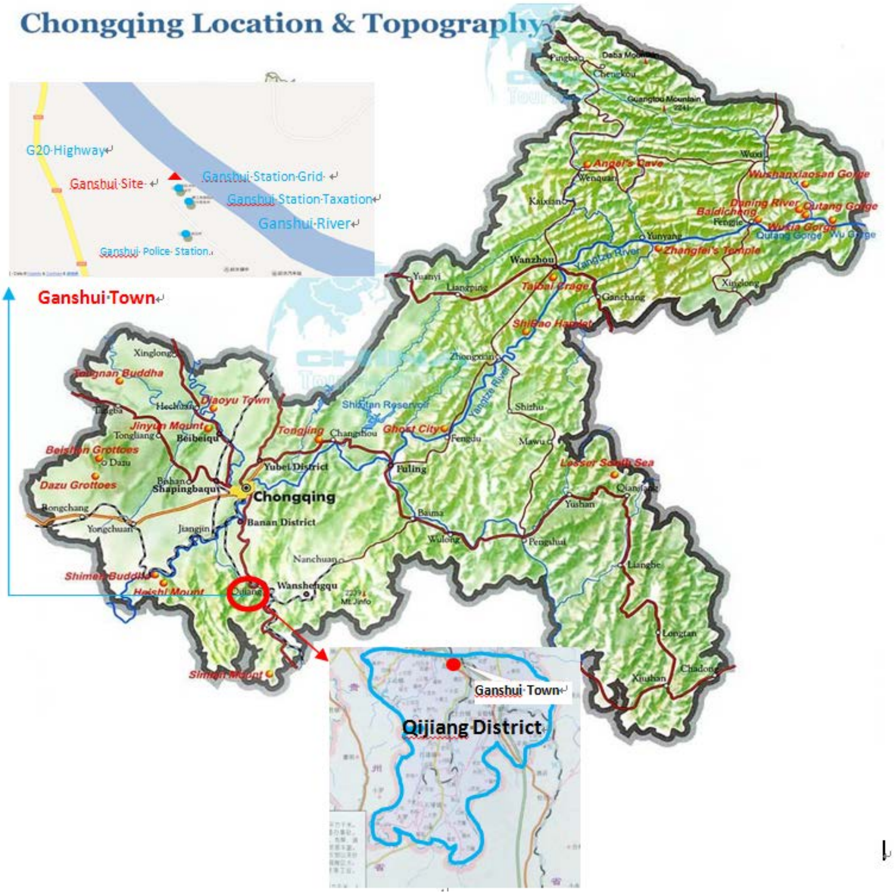


Figure 1 Location of Ganshui Warehouse

Ganshui Town is in the south of Qijiang District and adjacent to the Wansheng Economic Development Zone on the east, and Fuhuan Town of Qijiang District, Tongzi County of Guizhou Province on the south, and Xishui County of Guizhou City and Datong Town and Anwen Town on the west; and Dongxi Two on the north. Geographical coordinates of Ganshui warehouse fall in the scope of 106º42´11.53″ ~ 106º42´12.57″E and 28º44´57.22″ ~ 28º44´58.18″N.

(2) Climate and meteorology

Qijiang enjoys a humid climate of subtropical zone, with characteristics of East Asian monsoon of subtropical zone. It is warm in winter, droughty in spring, hot in summer and overcast in autumn, and enjoys abundant rainfall with many cloudy days and less sunshine. The temperature, sunshine and rainfall vary largely in different regions. The mean annual temperature is 18.8^{o}C, the annual average rainfall is about 1070 mm and the frost-free season covers 344 days on average.

(3) Hydrogeololgy

With many rivers running here, Qijiang is rich in water sources. Qijiang River, the largest river in Qijiang of 231.3 km long, is a branch of the Yangtze River. It originates in Guizhou Province, runs from the south to the north and enters the Yangtze River at the estuary in Jiangjin. The upper reaches of Qijiang River above Ganshui Town cover an area of 2,943.4 km^2, and that below Ganshui to the middle reaches in Gunan covers 1,737.4 km^2. The middle reaches is 59.9 km long, 60-100 m wide, with a max fall of 71 m, river bed gradient of 0.3‰ and mean annual runoff of 83.9m^3/s. Qijiang River has over 30 branches, including Yangdu River, Zaodu River, FuhuanRiver, Guofu River, Puhe River, Sanjiao River, Qingxi River and Ganshui River with drainage area of 100 km^2. Among those rivers, Ganshui River is nearest to this field with about 20 meters distance.

The groundwater of Qijiang District is loose rock pore water and bedrock fissure water. The pore water is distributed mainly in the silty clay of the Quaternary and mainly replenished by atmospheric rainfall and surface water. The fill stratum is characterized by a small thickness, small distribution area, poor soil permeability and non-abundant groundwater. The bedrock fissure water is mainly buried in gray-white and white sandstone of Upper Shaximiao Formation (J_{2s}), and the fissures in sandstone are the space for groundwater migration and storage. The groundwater is replenished by atmospheric precipitation and surface water and it is infiltrated along the fissures and controlled by the attitude of rock formations of this region and the minimum erosion surface of this region. The shallow groundwater is subject to short runoff pathways and discharged in valley bottom or low-lying areas, and its water volume, water temperature and water quality are significantly affected by the meteorology. Another groundwater continues the infiltration along the fissures to the deep underground, and it is subject to remote migration in a deeper position.

3.4.2. Social and Regional Overview

Economy of Qijiang District ranks the fifteenth in Chongqing. In 2013, the local fiscal income of Qijiang District was RMB 5.0 billion, and its gross industrial output value was RMB 41.7 billion; its total investment in fixed assets was RMB 22.3 billion; its total retail sales of consumer goods was RMB 8.85 billion; its per capita disposable income of urban residents was RMB 169,840,000 Yuan and its per capita net income of rural residents was 7,325 Yuan.

Gansui Town governs 21 administrative villages, 169 villagers groups, five communities and 29 residents groups, and covers an area of 193 km^2. It is home to a population of 86,000 or so. The whole town has 43000 Mu cultivated land and 117000 Mu forests. The main crops of Ganshui Town are rice, wheat, corn, vegetables, etc., and the cash crops are bamboo shoots, carrots, organs, grapefruit, peaches, pears, tea, etc. The typical soil of Ganshui Town is classified into seven categories, namely, paddy soil, purple soil, yellow soil, limestone soil, fluvo-aquic soil, yellow-brown soil and mountain meadow soil, which are dominated by paddy soil and purple soil.

There are city-owned and county-owned enterprises including Songzao Coalmine, Tutai Iron Ore and Zaodu Coalmine, one cement plant, eight township-owned coalmines and a group of coal transportation and distribution enterprises, which have formed the enterprise pattern predominated by building materials, energy development, machining and wholesale of industrial products.

Ganshui Town is populated by Han Chinese and dotted by ethnic minorities such as Miao, Yi, Buyi, etc. The main income sources of the residents are agriculture, livestock breeding industry and business & trading activities. Ganshui enjoys a developed culture and the traditional cultural and artistic items of Miao Nationality’s embroidery, basketball, prints, drum dance, yangko dance, dragon dance, etc. are very popular among the masses. There are one junior high school, six central primary schools and 22 village-level primary schools in this district. In addition, there are cultural relics under protection including Stone Carving, Dongyue Temple, Animal-releasing Stand, Hanging Coffins, etc.

3.4.3. Site Introduction

Ganshui warehouse is located at the northwest of Ganshui Town, Qijiang District of Chongqing. From the 1960s when this warehouse was built to the end of the 1990s, it was mainly used for storing relevant farming materials, such as pesticides, chemical fertilizers, seeds and farm tools. At the beginning of 2002, Ganshui Supply and Marketing Cooperative started to clear up this warehouse. However, up to now, storeroom that is previously used for storing pesticide still smells a strong smell of pesticides.

From 2002 to 2012, other storerooms of Ganshui warehouse (with the exception of pesticide storage room) are leased out, but their rent purposes are unable to trace. In December 2012, personnel of Chongqing University of Technology during the first field investigations found that the ground where fireworks and crackers were piled up was laid with plastic cloth and package of all the fireworks and crackers remained intact. Therefore, the possibility of site contamination resulting from leakage of gunpowder is relatively small.

Until July 2014, major structure of all the above-ground buildings on Ganshui Warehouse has remained complete and intact. However, as they are out of repair for long years, roof and wall of some storerooms has been damaged seriously and such storerooms are declared as dilapidated building for management by the Employer. Its status quo is shown in Figure 2.

Figure 2 Status Quo of Ganshui Warehouse (1) Front side of warehouse; (2) Reverse side of warehouse; (3) Left side of warehouse; (4) Right side of warehouse; (5) Keeping room; (6) Pesticide storage room inside the warehouse.

3.4.4. Land Use Planning After Remediation

According to Ganshui Planning Map for Land Use of Construction Planning (2003-2020), Ganshui warehouse has been planned as the residential land, with more details in Figure 3. Therefore, the Ganshui site after remediation will be used for residential land and can no longer be used for any commercial or industrial purposes, thus, it can be re-contaminated in the future, furthermore, the site environmental risk assessment and remediation (Section 4.5, 4.6) will correspondingly employ the standards of residential land use.

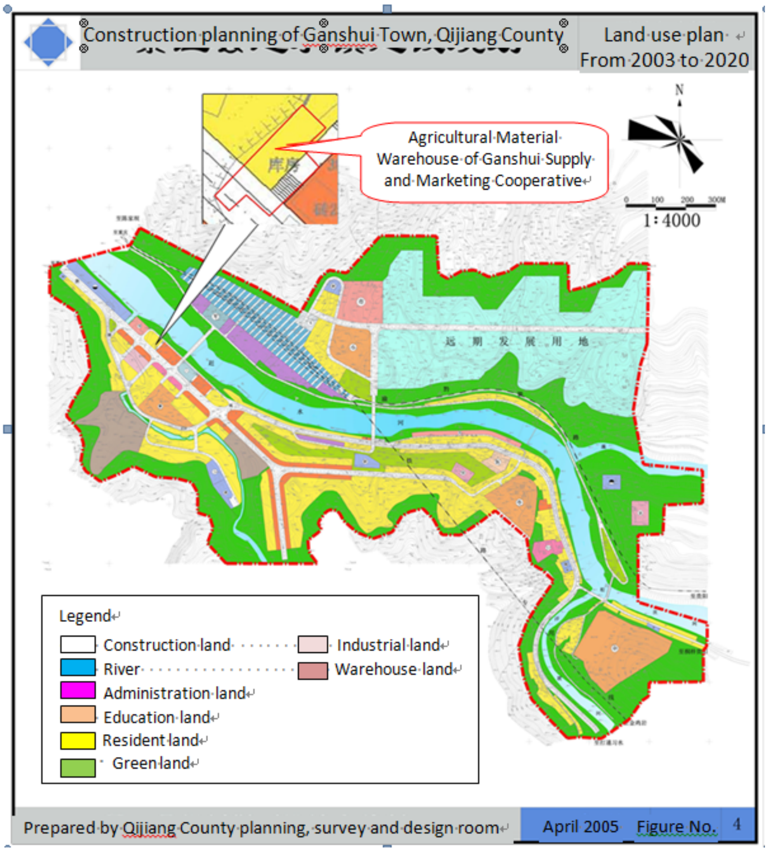


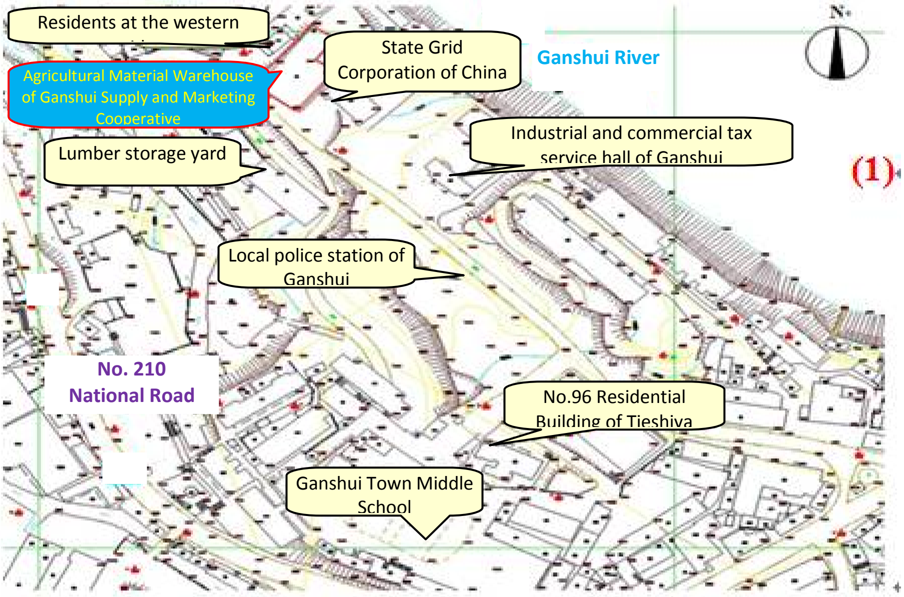
Figure 3 Land Use Plan for Ganshui Warehouse

3.4.5. Site Ownership

The Ganshui warehouse has its ownership of Ganshui Supply and Marketing, however, as one of the demonstrated site of China-GEF project, the Chongqing PMU was authorized as owner agent in the responsible for the convenient management including bids for site remediation, funds management, remediation validation and so on, the valid term was from the start to close out of site remediation.

3.4.6. Sensitive Targets

The sensitive targets of site environmental survey refer to residential area, school, hospital, administrative office area, commercial area, drinking water source protection area and public place and other places around the site possibly affected by the contaminants. Lumber storage yard at the southern side within 500 m of Ganshui site, some administrative office area at the eastern side, residential area at the western side and Ganshui river approximate 20 m away at the northern side are the sensitive targets around Ganshui warehouse. Please refer to Table 2 and Figure 4 for specific location and name.


Residents at the western
Agricultural Material Warehouse of Ganshui Supply and Marketing Cooperative
State Grid Corporation of China
Ganshui River
N
Industrial and commercial tax service hall of Ganshui
(1)
Lumber storage yard
Local police station of Ganshui
No. 210 National Road
No.96 Residential Building of Tieshiya
Ganshui Town Middle School


(2)
Original dormitory of warehousemen


(3)


(4)


(5)
赶水镇中


(6)


(7)

Figure 4 Sensitive Targets around Ganshui Warehouse (1) Distribution of sensitive targets around Ganshui warehouse (2) Status quo of Ganshui warehouse and original dormitory of storekeepers close to Ganshui warehouse; (3) Ganshui River about 20 m away from the northern side; (4) Residents at the western side; (5) Ganshui Town Middle School; (6) No.96 Residential Building of Tieshiya (7) Lumber storage yard of Ganshui Town; (8) Ganshui State Grid Corporation; (9) Ganshui industrial and commercial tax service hall; (10) Local police station of Ganshui.

Table 2 Sensitive Targets around Ganshui Warehouse

Photo No.	Name	Direction	Distance (m)	Usage and number of resident
2	Original dormitory of storekeepers close to Ganshui Warehouse	WS	1	House, 2 residents
3	Ganshui River	NE	20	Non-drinking water source; no site sewage to be discharged.
4	Residents at the western side of Ganshui warehouse	W	3~10	House, 15 residents
5	Ganshui Town Middle School	SSE	190	Teaching, the amount of teachers and students was about 2510
6	No.96 Residential Building	SE	180	Residential area, 100-200 persons

	of Tieshiya			
7	Lumber storage yard	N	10	Lumber yard, abandoned and uninhabited
8	State Grid Corporation of China in Ganshui Town	ESE	3	Office, about 15 persons
9	Industrial and commercial tax service hall of Ganshui	SE	60	Office, about 10 persons
10	Local police station of Ganshui	SE	80	Office, about 30 persons

3.4.7. Government Information

According to the requirements of Prevention and Control “Twelfth Five-Year” Plan of Chongqing Persistent Organic Pollutants (POPs) and Chongqing Planning of Creating National Environmental Protection Demonstration City (2010-2013), in 2012, Chongqing Management Center of Solid Waste took the lead in carrying out the environmental risk assessment of 10 pesticide POPs sites those used for storage in the original circulation, and Ganshui warehouse is one of the findings.

3.4.8. Pesticide Inventory

Due to historical reasons, record list about ex-warehouse and warehousing of Ganshui warehouse is missing. Main storage quantity of pesticide listed in table 3 is recorded on the basis of memory of personnel working in the warehouse and may deviate from actual quantity to a certain degree.

Table 3 Amount of Major Pesticides Stored in Ganshui Warehouse

No.	Name of pesticides	Unit	Amount of storage	Storage method	Storage site
1	DDTs	ton	0.5	500 g/bottle	Warehouse of Pesticides
2	BHCs	ton	1	25 kg/bag	
3	DDVP	ton	0.2	500 g/bottle	
4	Methamidophos	ton	0.3	500 g/bottle	
5	Rogor	ton	0.3	500 g/bottle	
6	Folimat	ton	0.5	500 g/bottle	
7	Asomate or urbacid	Memory of original workers at Ganshui warehouse about storage quantity of asomate is vague and unclear.			

The physical and chemical properties and toxicity of the main stored pesticides are as follows:

① **DDT:** Its chemical name is Dichlorodiphenyltrichloro ethane and its chemical formula is $(ClC_6H_4)_2CH(CCl_3)$. Its alias is 2,2-bis(4-chlorophenyl)-1,1,1-trichloroethane (i.e. p, p'- DDT); its major isomers and homologues are o, p'-DDT, p, p'-DDE and p, p'-DDD. DDT is black crystal and insoluble in water but soluble in kerosene. DDT is a kind of contaminant easily soluble in body fat and accumulated in it for a long time, and it can disrupt the hormone secretion of the creatures, damage the liver and kidney organs, cause the hepatomegaly and change the liver function. It may also cause oliguria, anuria and protein and red blood cells in urine, etc. and can irritate the skin to cause red swelling, burning sensation, itching and dermatitis. If it is splashed into the eyes, it may cause temporary blindness.

② **BHC:** It can be written as 666 and its component is hexachlorocyclohexane. It is the saturated compound formed that a hydrogen atom on each carbon atom of the cyclohexane is replaced by chlorine atoms. Its chemical formula is $C_6H_6Cl_6$. It can be seen as the benzene adduct of six chlorine atoms because the molecular structure contains six carbon atoms, six hydrogen atoms and six chlorine atoms, respectively. It is a kind of white crystal and has eight kinds of isomers. It is soluble in benzene and slightly soluble in chloroform and insoluble in water. BHC is of the functions of contact poison, stomach poison and smoked kill. Among them, the γ isomer has the highest insecticidal effect, α isomer has the second highest insecticidal effect, δ isomer follows and β isomer has extremely low insecticidal effect. Benzene hexachloride is stable in acid and can be easily decomposed in alkaline solution or in the zinc, iron and tin circumstance. It may lose efficacy when placed in the moisture or sunlight for a long time. BHC enjoys a moderate toxicity. Its acute toxicity is less. Through the comparison of the toxicity of its isomers, the toxicity of γ-BHC is the highest. After BHC enters the body, it is mainly accumulated in the central nervous system and adipose tissue to stimulate the brain activity and cerebellum and it can also affect the autonomic nervous system and peripheral nerves through the cortex and affect the oxidative phosphorylation of the cells in the organs, leading to organ malnutrition and degeneration and necrosis. It can induce the microsomal oxidase of the liver cells, affect the endocrine activity and inhibit the enzyme ATP. The studies have proven that α-BHC has a higher carcinogenic nature.

③ **Methamidophos:** Methamidophos is a kind of organic phosphorus compound, often used as a pesticide. It is called DAMASONG in Taiwan and DUOMIELING in mainland China. It has been disabled in some countries such as Japan due to its high toxicity. Its production and use has been officially stopped by mainland China since 2008. Methamidophos is a kind of white needle-like crystal. It is easily soluble in water and alcohol and soluble in chloroform, benzene and ether. Its solubility in toluene and xylene is less than 10%. Its hydrolysis is not fast in weak acid and weak base and it is fast in strong alkaline solution. Methamidophos is a kind of efficient organophosphorus insecticide with a wide insect-killing range. A short-term exposure and contact (oral administration, inhalation, skin, mucous membrane) may cause the acute poisoning. The manifestations include headache, dizziness, loss of appetite, nausea, vomiting, abdominal pain, diarrhea, salivation, restlessness, increased respiratory secretions, sweating, muscle bundle tremors, and so on. In case of severe conditions, it may cause pulmonary edema, cerebral edema, coma and respiratory paralysis. In some cases, it may even damage the heart, liver and kidney. In some severe cases, the heart, liver and kidney may be damaged. In some severe cases, the peripheral neuropathy may occur a few weeks or months after regaining the consciousness. It may lead to the delayed death in individual serious cases.

④ **Rogor Dimethoate:** Its alias is LE GE, and O, O-dimethyl-S- (N-methy lcarbamoylmethyl) phosphoradithioate. Its chemical formula is $C_5H_{12}NO_3PS_2$. The original chemical drug belongs to colorless crystal. Its industrial goods is the yellow-brown oily liquid. It is slightly soluble in water and soluble in most organic solvents, such as, alcohols, ketones, ethers, esters, benzene, toluene, etc. Dimethoate is a kind of insecticide with moderate toxicity and the absorptive organophosphorus insecticide and miticide, with a wide insecticidal range and with strong contact poison and certain stomach poison functions against insects and mites. It can be oxidized into omethoate with a higher activity in insects and its action mechanism is to inhibit the acetylcholinesterase in the insects and impede the nerve conduction and lead to the death. After being absorbed by human body, a part of dimethoate is oxidized into the omethoate of inhibiting the cholinesterase to inhibit the cholinesterase activity and cause the neurophysiological dysfunction.

⑤ **Folimat:** It is also called as omethoate. Its chemical name: O,O-dimethyl-S-[2-(methylamino)-2-oxo-ethyl] phosphorothioate. Pure omethoate is the colorless transparent oily liquid and industrial omethoate is light yellow oily liquid. It is the organophosphorus insecticide and miticide with a high toxicity and high efficacy and broad spectrum activity. It can quickly kill the pests and it is of strong internal absorption, contact poison and certain stomach poison functions. It has a high toxicity for the human beings and animals.

⑥ **DDVP:** Also called DDVP (dimethyl-dichloro-vinyl-phosphate, dichlorovinyl dimethyl phosphate). It is a kind of organophosphorus insecticides, with chemical formula of $C_4H_7O_4Cl_2P$. It is a kind of colorless oily liquid with volatility and it is used to prevent and control the agricultural pests including cotton aphid and also used to kill mosquitoes and flies. The pure DDVP is colorless – amber liquid, with aromatic flavor. Its relative density is 1.42. With a boiling point of 74℃(133.32Pa) at the room temperature, its solubility in water is 10g/L and its solubility in kerosene is 2-3g/kg. It can be blended with most organic solvents and miscible aerosols, and it is stable against the heat, but it can be hydrolyzed and its hydrolysis speed becomes faster in alkaline solution. 80% DDVP emulsion is the light yellow – yellow-brown transparent liquid. DDVP is a kind of insecticide with moderate toxicity. 80% DDVP can be inhaled through oral administration, skin absorption or respiratory tract. The incubation period of the poisoning patients for oral administer is short and its onset is fast with severe complications, usually followed by coma, which can lead to death within a few minutes. The gastrointestinal symptoms for the oral administer are apparent.

⑦ **Glyphosate:** Scientific name: N-(phosphonomethyl) glycine or N-(phosphonomethyl) aminoacetic acid, with the chemical formula of $(HO)_2P(O)CH_2NBHC_2COOH$. It is a kind of white crystal and easily soluble in water, ethanol, acetone, chlorobeenzene, xylene and kerosene. It is incombustible and stable at room temperature. It is easy for transportation. It is a kind of organophosphorus herbicide with a low toxicity. After being ingested by mouth, it generally results in nausea, emesis, epigastric pain or even alimentary tract hemorrhage and diarrhea. It can easily cause aspiration pneumonia and (or) pulmonary edema, cough, chest tightness and breathing difficulty, and even cause the death due to respiratory failure in severe cases.

⑧ **Decamethrin (deltamethrin) decamethrin:** Pure decamethrin is white crystal and its raw drug is the white odorless powder. It is used to prevent and control the pests of rice and cotton. The skin contact may cause irritation symptoms with red pimples. In case of an acute poisoning, it can cause headache, dizziness, nausea, vomiting, loss of appetite and fatigue under common conditions, and even result in muscle bundle tremors and convulsions in severe cases.

⑨ **Asomate**: Its chemical name is tri (N- dimethyl aminodithioformic acid) arsine. Pure product of the original chemical drug is yellow and green prismatic shape crystal with melting point being 224℃-226℃. It is insoluble in water, but slightly soluble in acetone and methanol. 60% of it can be dissolved in the boiling benzene. It is generally stable under normal temperature but may easily become decomposed when encountering concentrated acid or heat. Asomate is a kind of pesticide containing arsenic and used for preventing plant diseases. It is mainly used for preventing apple canker or for curing powdery mildew, pear scab, rice blast, corn northern leaf blight and soybean frogeye leaf spot. Toxic symptom: chronic poisoning is represented by weakness, lack of power, loss of appetite, nausea and vomiting and diarrhea. Acute poisoning is represented by nausea and vomiting, abdominal pain, diarrhea, thirst, jerk, headache, cough, chest pain and difficult breathing.

3.4.9. Field Exploration

The field exploration records are detailed in Annex 1 (Exploration pictures of Ganshui site) and Annex 2 (Exploration questionnaires of Ganshui site) as follows:

- Investigations of transformers and capacitors
  There is no transformer in Ganshui site.
- Radioactive and radiation sources in the plant
  There is no radiation source in Ganshui site.
- Environmental pollution accidents and complaints
  No environmental pollution accident and complaint happened in the history of the survey site.
- Occupational disease
  No occupational disease happened among the employees of the companies in survey site.
- Discharge of pollution sources
  The handling and storage of pesticides of Ganshui warehouse may cause the leakage and volatility of the pesticides due to possible damage of packages, which may cause certain pollution to the surrounding environment.
  No governance measure was taken to the efflux of garbage and domestic sewage of the warehouse caregivers.
- Investigations of pipeline leakage
  There are drain ditches around Ganshui warehouse, which are mainly used to discharge the rainwater, and there is no production and sewage pipeline.
- Substances in tanks and leakage evaluation
  There was no tank used in Ganshui site.

The field survey and interview results show that there is no underground and ground storage tank in the survey site.

3.4.10. Migration Analysis of Contaminants

There exist possible pesticide leakages during the pesticide storage in Ganshui warehouse, which may cause certain pollution to the site. Ganshui warehouse is located in a relatively flat terrain, so there is a less possibility of migration of leaked pesticide due to the topography.

The survey results show that the residents and enterprises near Ganshui warehouse all use the municipal tap water because the shallow water in the site is not developed. The nearest groundwater well from the target site is in the yard of Ganshui State Grid with well depth of about 40m. In this survey, the water samples are collected to analyze the impacts of soil contamination on the groundwater.

3.4.11. Identification Result of Site Pollution Factors

The leakage may exist during the pesticide storage and may cause pollution to soils. For this reason, at the qualitative evaluation stage, the sampling analysis is carried out in Ganshui warehouse according to the principle of stratified distribution.

Monitoring indexes: pH, lead, mercury, cadmium, arsenic, chromium, copper, zinc, nickel, organo-chlorine pesticide (hereinafter referred to as OC, focusing on DDT and BHC), organophosphorus pesticide (hereinafter referred to as OP, focusing on dichlorvos, dimethoate, methamidophos and glyphosate).

3.4.12. Healthy Impact on Warehouse management Workers

Ganshui site is the pesticide storage warehouse and its main affected objects are the storekeepers, which may cause physical and healthy impacts on them.

The field survey shows that the pesticides in Ganshui Warehouse are stored in separate warehouse with the ventilation louvers. The original work specifications for warehouse management are lost due to historical reasons. Upon the memories of the Employer and some staff, the storekeepers are equipped with uniforms, protective gloves and protective masks and they do not contact the pesticides in normal circumstances. After completing the operations, they shall use soap to wash the face and hands, and rinse the mouth with water and so on. The protective articles or tools shall be cleaned in time and stored in a concentrated way. The work rules of the said specifications can reduce the healthy impact of the pesticides on the storekeepers.

In addition, through the consultant with the former storekeepers (see 8.2.), they are currently in good health and there is no major disease possibly caused by the pesticides.

3.5. Phase-II Site Environmental Investigation

3.5.1. Preliminary Sampling Investigations for Pollution Identification

3.5.1.1. Preliminary Sampling Program

(1) Sampling location

According to the requirements of Technical Guide for Environmental Risk Assessment of Sites in Chongqing and Technical Guideline of Environmental Site Investigations, the soil sampling of phase-II environmental investigations shall be laid out in accordance with the location of pollutant source, migration nature of pollution factors and site characteristics. Preliminary sampling layout program is depicted as follows: set Ganshui 1# soil sampling point inside pesticide storage room and establish Ganshui 2# soil sampling point inside other materials storage areas. The said two soil sampling points are generally arranged inside Ganshui warehouse. Refer to Figure 5 for specific soil sampling points.

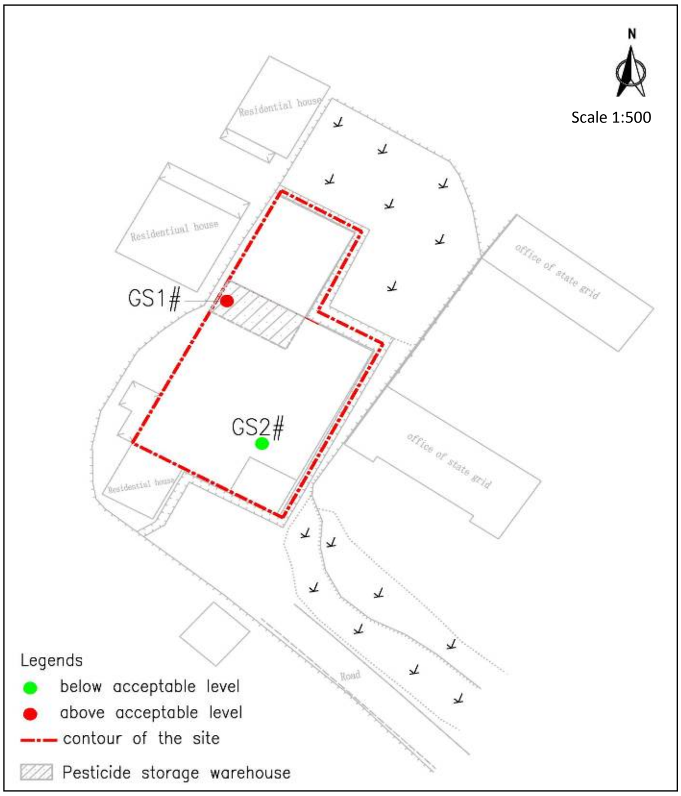


Figure 5 Preliminary Sampling Location of Ganshui Site

(2) Sampling preparations

The materials and equipment to be prepared for site sampling include: locator (GPS and total station device), site detector, soil sampler (sample bottles, spades, shovels, piece bamboos, etc.), sample preservation devices (sample boxes, blue ice, etc.), sample record sheets (Annex 3 –Soil sampling record of Ganshui preliminary site investigations), PPEs (PE disposable gloves, masks, helmet etc.), and so on.

(3) Collection of soil samples

In strict accordance with the provisions of Technical Guide for Environmental Risk Assessment of Sites in Chongqing and Technical Guideline of Environmental Site Investigations (HJ25.2-2014), the surface soil samples are collected through the digging mode by spades, shovels, piece bamboo and other simple tools, and it is required to make a concerted effort to reduce the soil disturbance and make sure there is no secondary pollution during the sampling process.

Select the manual spiral auger to collect soil profile samples, sample the raw soil, and the sampling photo of the site is shown in Annex 4 (Sampling pictures of Ganshui site), with the specific process listed as follows:

- Use the shovels to excavate the hardened surface layer and clean the working area of about 2 m^2;
- Use the manual spiral auger to drill downward and avoid the underground pipelines and tanks. Use the soil sampler to collect the soil core sample every 0.5 m and put the soil samples into the sample bottle with protective liquid;
- Observe the formation type, compaction, humidity and color of the soil during the sampling, and pay special attention to the existence of abnormal stain or odor, and meanwhile, record the observations and observation results;
- The soil shovel, drill bit and drill pipe shall be cleaned by tap water before the re-drilling starts;

- During the drilling or digging process, the drilling operation shall be stopped to end the sampling when it has reached the underground water layer or weathered bedrock.

(4) Preservation and transportation of soil samples

- When sampling the soils, the sampling operators shall all wear disposable PE (polyethylene) gloves. New gloves shall be worn before each sampling of soil to prevent the cross contamination among soil samples.
- The bamboo blade is used to cut the topsoil contacting with drill tube and after removing the gravels and plant roots from the soil, the soil shall be collected and put into the sampling bottles provided by the laboratory. The blade shall be cleaned by tap water after sampling a piece of sample.
- The selected soil samples shall be immediately placed into pre-prepared and labeled special soil bottles. The bottles shall be put into the preservation box on the site with a low temperature of 0-4^{o}C after they are sealed.
- The transfer sheet shall be prepared, and the packaged samples shall be sent to SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. (hereinafter called SGS Company) for laboratory analysis. The transportation time of the samples may not be more than 48 hours.

(5) Monitoring factor of soil samples

After the analysis of site historical use, it is preliminarily determined that monitoring factors of soil samples at Ganshui site are 8 kinds of typical heavy metals (lead, cadmium, arsenic, chrome, copper, zinc, nickel and mercury) and pesticide contaminants, such asα-BHC, γ-BHC, β-BHC, δ-BHC, o,p'-DDE, p,p'-DDE, o,p'-DDD, p,p'-DDD, o,p'-DDT, p,p'-DDT, DDVP, rogor, methamidophos and glyphosate.

(6) Positioning measurement of soil sampling points

Firstly, define the boundary scope of Ganshui site, distribute points according to predetermined plan, determine grid position through site landmark building, use tape to measure and release points and utilize special mark to mark each point position. If barriers, such as foundation, gutterway and sewer of buildings, are encountered, make adjustments according to actual circumstances of the site, determine actual sampling position, and decide the coordinates of sampling point location according to independent coordinate system of Chongqing Municipality again.

After the end of sampling operations, Yuqi Planning and Design Institute of Qijiang District will use the total station device and GPS satellite positioning system to determine the specific coordinate and elevation of the sampling points. The measurement process photo records are shown in Annex 5 (Position measurement on Ganshui site). See Table 4 for detailed survey results.

Table 4 Sampling Record of Ganshui Site Environmental Investigations

No.	Monitoring point	Sampling depth	Elevation	Soil properties	Coordinate		Monitoring items
					N	E	
1	Ganshui 1#	0.2m	300.5m	Red-brown sandy soil	28°44′57.92″	106°42′12.16″	pH, lead, mercury, cadmium, arsenic, chromium, copper, zinc, nickel, OC (focusing on DDT and BHC), OP (focusing on dichlorvos, dimethoate and methamidophos).
2	Ganshui 2#	0.2m	300.9m	Red-brown clay	28°44′57.63″	106°42′12.00″	

3.5.1.2. Sample Detection and Analysis

(I) Detection method

According to the Technical Guideline of Site Environmental Risk Assessment in Chongqing (Chongqing Administration of Environmental Protection 2010), the soil and underground water samples detection methods of Screening Value of Site Environmental Risk Assessment (DB11/T811-2011) are preferentially used, and the USEPA (sw846) standards were used as supplement, and the detailed detection method and detection limit are in Table 5.

Table 5 Detection Method and Detection Limit

No.	Description	Adopted standard for soil sample	Analysis method for soil sample	Detection limit for soil sample (mg/kg)	Adopted standard for water sample	Analysis method for water sample	Detection limit for water sample (μg/L)
1	pH	USEPA 9045D-2004	Electrode method	0.1 pH unit	APHA 4500H$^+$-2012	Electrode method	0.1 pH unit
2	Pb	HJ 350-2007 Appendix A	Atomic emission spectrometry of inductively coupled plasma	0.1	USEPA 200.8-1994	ICP-MS	5
3	Cd			0.01	--	--	--
4	As			0.5	USEPA 200.8-1994	ICP-MS	1
5	Cr			0.1	--	--	--
6	Cu			0.1	--	--	--
7	Zn			0.5	--	--	--
8	Ni			0.1	--	--	--
9	Hg	USEPA 7473-1998	Cold atomic absorption spectrometry	0.01	USEPA 7473-1998	Cold atomic absorption spectrometry	0.1
10	α-BHC	HJ 350- 2007 Appendix G	GC-ECD	0.01	USEPA 8081B-2007	GC-MS	0.1
11	γ-BHC			0.01			0.1
12	β-BHC			0.01			0.1
13	δ-BHC			0.01			0.1
14	o, p'-DDE			0.01			0.1
15	p, p'-DDE			0.01			0.1
16	o, p'-DDD			0.01			0.1
17	p, p'-DDD			0.01			0.1
18	o, p'-DDT			0.01			0.1
19	p, p'-DDT			0.01			0.1
20	DDVP	USEPA 8141B-2007	GC-MS	0.01	--	--	--
21	Rogor			0.01	--	--	--
22	Methamidophos			0.1	--	--	--
23	Glyphosate	USEPA 8141B-2007	GC-MS	0.025	--	--	--
24	1,2-Dithloroethane	--	--	--	USEPA 8260C-2006	GC-MS	0.5
25	Chloromethane	--	--	--			0.5

26	Trichloromethane	--	--	--			0.5
27	Bromodichloromethane	--	--	--			0.5
28	Dibromochloromethane	--	--	--			0.5

"—" means that the item was not tested in this report.

(II) Sample detection process

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd (hereinafter called SGS Company) is authorized to complete the detection of soil samples, and the detection process is as follows:

(1) Sample preparation

There are a wide range of soils and contaminants that require different sample preparation methods and detection methods. the national detection method is preferred. If it is not specified in Environmental Quality Standard for Soils or the item is lack in detection method, the equivalent methods can be adopted.

(2) Sample detection

The detection of samples shall be carried out by certified operators in strict accordance with the methods, instrument and operating specifications prescribed in HJ350-2007.

(3) Detection record

The detection record shall be designed into the record sheet format, with complete pages and contents, and filled out in detail and clearly with carbon ink pen. In case of any correction, draw a line through the wrong data (text) and write the correct content on their top and affix the stamp or signature of the corrector on the line. It can also be designed into the loose-leaf format to be circulated and preserved with the analysis report for convenience of review; it can be designed into the output (printed copy) in electronic version or the magnetic disk and CD-ROM memorized with the information.

The statutory measurement unit to be used shall only leave a suspicious digit while recording the measured data. The digits of significant figures shall be determined according to accuracy of metering instruments and displaying value of analytical instruments, and it may not be added or deleted at random.

(4) Data processing

The computation and rounding rules of the significant figures shall comply with the Standard GB8170. The outliers resulted from the error of sampling, transportation, storage and analysis shall be deleted.

The determination result of parallel samples shall be indicated by the average value. A group of determination data shall be reported with the average value after their outliers (data) have been deleted through Dixon method and Grubbs method. The determination result lower than the detection limit of analysis method shall be reported as "undetected". As for the statistics, it shall be computed as per half of the minimum detection limit.

Three significant digits are generally saved for the determination of soil samples and two significant digits are saved for the cadmium and mercury with a lower level, and meanwhile, the detection limit value shall be indicated. Only one significant figure is taken in general for precision data of analysis result, and in case of a large amount of determination data, it is desirable to take two significant figures. The digits representing the significant figures of analysis result may not exceed the minimum digit of method detection limit.

(5) Detection report

The detection report should include report name, laboratory name, report number, per page and total pages of the report, name of sampling sites, sampling time, analysis time, detection method, monitoring basis, evaluation criteria, monitoring data, single-item evaluation, overall conclusion, number of monitoring instrument, detection limit (to be listed as “undetected”), schematic diagram of sampling points, sampler (assignee), analyzer, report preparer, reviewer, auditor and issuer, time, and other contents.

(III) Quality control

Various links of site survey and monitoring (i.e. sampling layout, sample collection, storage, transportation, analysis, data processing, etc.) shall all be carried out in accordance with the requirements of relevant national standards and environment monitoring technical specifications.

The soil shall be sampled in strict accordance with the provisions of Technical Guideline of Site Environmental Monitoring.

The detection of soil samples has been authorized to SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd (hereinafter called SGS Company). SGS Company has passed the metering certification and qualification certification (Annex 6 Inspection Qualification of SGS Company) and has the strict laboratory quality assurance system. The monitor and analyzers are qualified upon the examination and go on duty with certificates, which has provided the guarantee for fairness, justice and accuracy of monitoring data. Instrument and metering instrument are all sent for inspection periodically and they are used in their validity.

The main contents of laboratory quality control include:

- Blank Sample: All target compounds cannot be detected in the blank sample;
- Detection Limit: The method detection limit of each chemical shall meet the requirements;
- Spike Recovery: The spike recovery of each chemical shall meet the requirements;
- Duplicate Sample: The allowable relative percentage error of duplicate samples shall meet the requirements;
- Timing Inspection of Laboratory Instrument: All lab instruments are within the deadline for inspections;
- The laboratory has passed the qualification and metering certification and had the corresponding analysis and detection qualification.

The laboratory quality control situation is shown in Table 6, which has guaranteed the quality of analysis and detection data.

Table 6 Laboratory Quality Control (QA/QC)

Determine item	DUP%RPD	LCS% recovery	MS% recovery	MSD%RPD
Pb	3%	107%	102%	7%
Hg	15%	86%	96%	6
Cd	0%	97%	93%	7%
As	4%	107%	105%	2%
Cr	8%	107%	89%	2%
Cu	2%	99%	91%	13%
Zn	2%	90%	91%	8%
Ni	8%	106%	99%	8%

α-BHC	0%	70%	74%	4%
γ-BHC	0%	71%	73%	4%
β-BHC	0%	72%	70%	9%
δ-BHC	0%	71%	78%	14%
o, p'-DDE	0%	72%	NA	NA
p, p'-DDE	16%	72%	81%	17%
o, p'-DDD	0%	80%	NA	NA
p, p'-DDD	0%	80%	96%	7%
o, p'-DDT	0%	84%	NA	NA
p, p'-DDT	0%	72%	103%	4%
DDVP	0%	120%	94%	21%
Rogor	0%	124%	118%	8%

Note: LCS means the recovery rate of laboratory control samples while MS means matrix spike recovery, indicated by Recovery%;
DUP and MSD refer to the relative differences between duplicate samples and duplicate sample spike recovery, indicated by RPD%;
NA means that recovery rate is not available when test result limit is lower than detection limit.

3.5.1.3. Result and Evaluation

(I) Test results

According to the test reports of SGS Company, the results of soil samples of Ganshui site, including pH, lead, mercury, cadmium, arsenic, chromium, copper, zinc, nickel, OC (focus on DDT and BHC), OP (focus on dichlorvos and dimethoate), methamidophos and glyphosate are shown in Table 7, and the test data are detailed in Annex 7 (Test report of soil samples of Ganshui preliminary site investigations).

Table 7 Determination Results of Preliminary Sampled Soils (mg/kg excluding pH)

Monitoring item	Ganshui 1#	Ganshui 2#	Monitoring item	Ganshui 1#	Ganshui 2#
pH	7.6	4.3	o, p'-DDE	nd	nd
Pb	49.5	21.7	p, p'-DDE	0.15	0.01
Hg	3.77	0.08	o, p'-DDD	nd	nd
Cd	nd	nd	p, p'-DDD	nd	0.01
As	**238**	3.6	o, p'-DDT	0.11	0.05
Cr	26.5	24.4	p, p'-DDT	0.34	0.11
Cu	38.8	10.5	DDVP	nd	nd
Zn	123	45.4	Rogor	nd	nd
Ni	18.9	16.3	Methamidophos	nd	nd
α-BHC	**1.10**	nd	Glyphosate	nd	nd
γ-BHC	0.11	nd	δ-BHC	0.21	nd

β-BHC	**4.04**	0.04			

Note: nd means that the sample is not detected;
Figure in red means that such figure has exceeded the standards;

(II) Evaluation criteria

Whereas China has yet no national standard for site environmental risk assessment, and the Standard of Soil Quality Assessment for Exhibition Sites (HJ350-2007) (On Trial) lack of the standard limit values for some contaminants (BHCs and DDTs isomers).

According to the provisions of Technical Guide for Environmental Risk Assessment of Sites in Chongqing and the future land plan of Ganshui warehouse, the site environmental risk assessment will adopt the standard of residential land use with reference to Beijing's Screening Levels for Soil Environmental Risk Assessment of Sites (DB11/T811-2011) (hereinafter referred to as Beijing's Screening Levels). The target contaminants without standard limit value shall comply with the United States EPA Generic SSLs (2013). The standard limit values of various monitoring factors are detailed in Table 8.

Table 8 Screening Levels for Soil Environmental Risk (mg/kg)

No.	Item	Standard limit for soils [a] (mg/kg)	USEPA Standard limit for soils [b] (mg/kg)	No.	Item	Standard limit for soils [a] (mg/kg)	USEPA Standard limit for soils [b] (mg/kg)
1	Pb	400	400	9	α-BHC	0.2	0.085
2	Hg	10	0.94	10	β-BHC	0.2	0.3
3	Cd	8	--	11	γ-BHC	0.3	0.56
4	As	20	0.67	12	δ-BHC	2	0.3
5	Cr	250	--	13	DDVP	--	1.7
6	Cu	600	310	14	Rogor	--	12
7	Zn	3500	2300	15	Methamidophos	--	3.1
8	Ni	50	--	16	Glyphosate	--	6100
10	Total BCH	--	1	17	p,p'-DDE	1	1.6
11	Total DDTs	1	--	18	p,p'-DDD	2	2.2

Note: "a" means Beijing's Screening Levels for Soil Environmental Risk Assessment of Sites (DB11/T811 -2011) while "b" means United States EPA Generic SSLs (2013).
"--"means item deficiency.

(III) Assessment result

Arsenic, α-BHC and β-BHC level in the soils of 1# monitoring point of original site of Ganshui Warehouse exceeded the standard limits of Beijing's Screening Levels for Soil Environmental Risk Assessment of Sites, and lead, cadmium, chromium, copper, zinc, nickel, organochlorine pesticide, DDTs, dichlorvos, dimethoate, methamidophos and glyphosate concentration in soils did not exceed the Beijing's Screening Levels. The quality of the soil is ineligible as residential land. Therefore, according to Technical Guide for Environmental Risk Assessment of Sites in Chongqing, Ganshui site requires the quantitative evaluation of site environment risks.

Lead, mercury, cadmium, arsenic, chromium, copper, zinc, nickel, organochlorine pesticide and organophosphorus pesticides in soils of 2# point of Ganshui site did not exceed the Beijing's Screening Levels.

Soil contamination of Ganshui site is mainly caused by leakage or scattering of pesticide during the storage period. Among these, arsenic may come from asomate or urbacid, while α-BHC and β-BHC mainly come from BHC pesticides. These three kinds of pesticides mentioned above have been applied in China widely and previously.

The level of target contaminants in soils of Ganshui 2# point did not exceed the Beijing's Screening Levels and United States EPA Generic SSLs, which indicates that the surface soil in this point is not contaminated.

To sum up, it is preliminarily determined that Ganshui site is polluted by pesticide POPs and arsenic and BHC are the target contaminants of the site, and their levels in the soils have exceeded the Beijing's Screening Levels, and the further investigations and analysis shall be carried out.

3.5.2. Preliminary Sampling Investigations for Pollution Identification

3.5.2.1. Detailed Sampling Program

According to qualitative evaluation conclusion of Ganshui site environmental investigations, the total 12 points are set for detailed sampling (Figure 6, including sampling point of background soil with number being DZ. As it is far away from Ganshui site, it is not shown in this figure). Record chart of soil samples is shown in Table 9:

(1) Ganshui D1# point was set at 1 m from Ganshui 1# point that was determined as the exceeded one at the Phase I investigations, and adding a sampling point 9# inside pesticide storage room.

(2) As Ganshui site area is relatively small, expert judgment methods are adopted for the sampling layout at the detailed site environmental investigations. Refer to Figure 6 for the sampling points. Soil samples collected are determined for the concentration of mercury, arsenic and BHCs so as to conduct quantitative risk evaluations.

(3) Ganshui D2#, Ganshui D3# and Ganshui D6# are arranged inside Ganshui warehouse in order to investigate the soil pollution conditions of other areas (pesticide loading and unloading area and aisle) with the exception of pesticide warehouse;

(4) Ganshui D4#, Ganshui D5#, Ganshui D7#, Ganshui D8# and 15# are set outside Ganshui warehouse in order to investigate the pollution caused by pesticide storage to soil outside warehouse and confirming whether pesticide pollution scope is only confined to Ganshui warehouse or not.

(5) In order to confirm that pollution of Ganshui site is caused by human activities, it is necessary to set 1 sampling point of background soil (DZ), and use shovel to remove the plants and humus layer on the surface layer of soil for collecting 0-10 cm soil. The setup principle for background point of Ganshui site: it shall be located in the upper drift of the dominant wind of Ganshui site, its terrain shall be higher than the target site; it shall be in a place not or seldom disturbed by man. For these reasons, the background point is laid out in the northwest of Ganshui site, mostly wasteland slope with a large number of weeds and shrubberies growing on the surface, and it is about 280 m away from the site (elevation 315 m or so).

(6) Refer to Annex 8 (Sampling record of Ganshui detailed site investigations) for record chart of the detailed investigations at Ganshui site.

(7) For the methods to collect, store and determine the soil samples, refer to the preliminary sampling program.

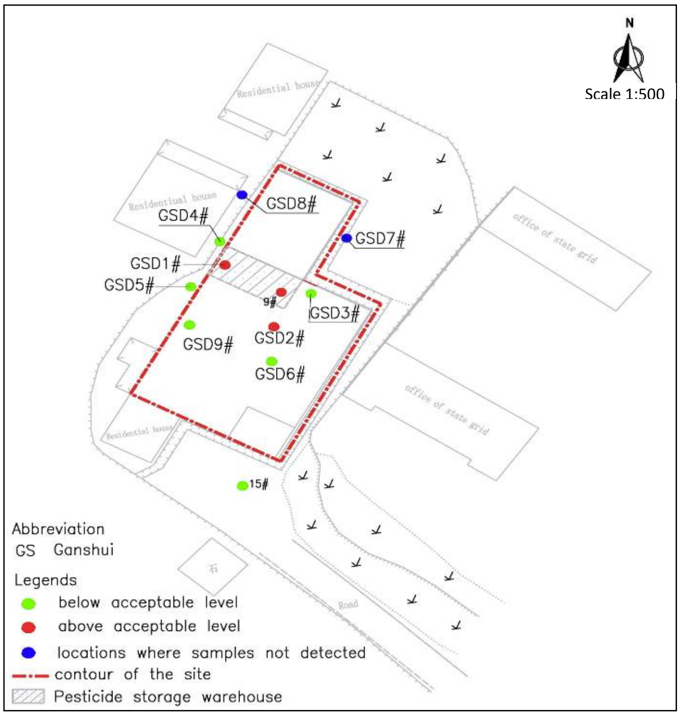


Figure 6 Sampling Layout of the Detailed Ganshui Site Investigations

Table 9 Soil Sample Records of the Detailed Site Investigations

Number of sampling point	Sample No.	Sampling depth (m)	Soil properties	Monitoring factor	Remarks
Ganshui D1#	Ganshui D1# - 1	0.2	Ground hardening layer	-------	Ganshui D1#-1 is ground hardening layer and not sent for detections
	Ganshui D1# -2	0.5	Red-brown sandy soil	Mercury, arsenic and BHCs	
	Ganshui D1# - 3	1.0	Red-brown sandy soil		
	Ganshui D1# - 4	1.5	Red-brown clay		
Ganshui D2#	Ganshui D2# - 1	0.2	Red-brown clay	Mercury, arsenic and BHCs	
	Ganshui D2# - 2	0.5	Red-brown clay		
Ganshui D3#	Ganshui D3# - 1	0.2	Red-brown clay	Mercury, arsenic and BHCs	
	Ganshui D3# - 2	0.5	Red-brown clay		
	Ganshui D3# - 3	0.9	Red-brown clay		
Ganshui D4#	Ganshui D4# - 1	0.2	Brown sandy soil	Mercury, arsenic and BHCs	
Ganshui D5#	Ganshui D5# - 1	0.2	Red-brown sandy soil	Mercury, arsenic and BHCs	
	Ganshui D5# - 2	0.4	Red-brown clay		
Ganshui D6#	Ganshui D6# - 1	0.2	Red-brown clay	Mercury, arsenic and BHCs	
	Ganshui D6# - 2	0.5	Red-brown clay		
Ganshui D7#	Ganshui D7# - 1	0.2	Red-brown clay	Mercury, arsenic and BHCs	As sampling point is

	Ganshui D7# - 2	0.5	Brown clay		located outside warehouse and abandoned for a long time, possibility of pollution is relatively small. Therefore, it is not sent for detections.
Ganshui D8#	Ganshui D8# - 1	0.2	Red-brown clay	Mercury, arsenic and BHCs	
	Ganshui D8# - 2	0.5	Red-brown clay		
	Ganshui D8# - 3	1.0	Red-brown clay		
Ganshui D9#	Ganshui D9# - 1	0.2	Red-brown sandy soil	Mercury, arsenic and BHCs	Ganshui D9#-3 is strongly weathered and not sent for detections
	Ganshui D9# - 2	0.5	Red-brown clay		
	Ganshui D9# - 3	1.0	Strongly weathered		
9#	9#-1	0.2	Ground hardening layer	-------	9#-1 is non-ground hardening layer and not sent for detections
	9#-2	0.4	Red-brown sandy soil	Mercury, arsenic and BHCs	
	9#-3	0.6	Red-brown clay		
	9#-4	1.2	Red-brown clay		
	9#-5	1.6	Red-brown sandy soil		
15#	15#-1	0.2	Red-brown sandy soil	Mercury, arsenic and BHCs	
	15#-2	0.6	Red-brown clay		
DZ		0.2	Red-brown clay	Mercury, arsenic and BHCs	Background soil

3.5.2.2. Test Results

According to the test report of SGS Shanghai Laboratory, the results of soil samples are shown in Table 10 and Annex 9 (Test report of Ganshui detailed site investigations).

Table 10 Determination Results of Detailed Sampling Soils (mg/kg)

Sample No.	Monitoring Item				
	As	α-BHC	γ-BHC	β-BHC	δ-BHC
Ganshui D1#-2	5.8	nd	nd	0.02	nd
Ganshui D1#-3	3.2	0.02	nd	0.08	nd
Ganshui D1#-4	46	**0.79**	0.17	**5.35**	0.17
Ganshui D2#-1	1.0	**0.31**	0.01	**0.62**	0.01
Ganshui D2#-2	1.4	**0.21**	nd	**0.27**	nd
Ganshui D3#-1	4.9	0.01	nd	0.02	nd
Ganshui D3#-2	3.0	0.01	nd	0.01	nd
Ganshui D3#-3	1.6	nd	nd	nd	nd

Ganshui D4#-1	2.2	nd	nd	nd	nd
Ganshui D5#-1	7.9	nd	nd	nd	nd
Ganshui D5#-2	3.6	nd	nd	nd	nd
Ganshui D6#-1	1.4	nd	nd	0.02	nd
Ganshui D6#-2	0.9	nd	nd	nd	nd
Ganshui D9#-1	2.1	0.03	0.01	0.04	0.02
Ganshui D9#-2	2.5	0.01	nd	0.03	0.01
9#-2	2.5	nd	0.01	0.08	nd
9#-3	1.2	nd	nd	nd	nd
9#-4	1.2	**1.53**	**0.55**	**0.51**	0.03
9#-5	0.8	0.03	0.01	0.03	nd
15#-1	5.9	nd	nd	nd	nd
15#-2	4.5	nd	nd	nd	nd
DZ	2.0	nd	nd	nd	nd

Note: *Ganshui D7# and Ganshui D8# soil samples are not sent for inspections. It is judged by Chongqing University of Technology that possibility of pollution at these two sampling points is relatively small as they are located outside Ganshui warehouse and abandoned for a long time;

*nd means that the sample is not detected;

*Detection limit of α-BHC, γ-BHC, β-BHC and δ-BHC are 0.01 mg/kg;

*Figure in red means that such figure has exceeded the standards;

After determination results of soil samples are analyzed based on the residential standards specified in Beijing Screening Level, it is found that:

- In the soil of Ganshui D1# point (1.5 m deep) and Ganshui D2# point (0.2 m deep and 0.5 m deep), α-BHC and β-BHC have exceeded the specified contents; in the soil of 9# point (120 cm deep), α-BHC, β-BHC and γ-BHC have exceeded the specified contents while arsenic and BHCs in other detected samples do not exceed the specified contents.
- As Ganshui D4#, Ganshui D5# and 15# are located outside Ganshui warehouse, target contaminants are not detected, which suggests that pollution caused by pesticides, such as BHCs and DDTs, is only confined to Ganshui warehouse.
- In the sample of soil on the surface layer of background point (DZ), the target contaminants of α-BHC, γ-BHC, β-BHC, δ-BHC are not detected, and the arsenic content is lower than that of Chongqing soil background values (arsenic background contents of Chongqing purple soils were in the range of 3.52-13.66 mg/kg)[2], suggesting that soil contamination at Ganshui site is mainly caused by pesticide storage activities while not existing naturally in the soil.

It is confirmed by the phase-II site investigations that Ganshui site was contaminated by POPs pesticides and the polluted scope mostly is located inside pesticide storage room. Among these, BHC pollutants have migrated downwards from surface soil; however, other local sporadic contaminated points inside Ganshui warehouse may possibly be caused by leakage

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[2] Chen Nian, Lai Weiping, Xu Maoqi, et al. 11 kinds of elements in soil environmental background value in Chongqing [J]. Journal of Chongqing Environmental Protection, 1982, 4:38-51.

of pesticides during the transportation process. Therefore, the phase-III site environmental survey is required in order to determine the contamination scope and depth and to work out the environmental health risk.

3.6. Phase-III Site Environmental Investigations

According to the results of phase-II investigations, it is revealed that Ganshui site was contaminated by POPs pesticides. In order to evaluate site health risks and determine remediation program, the phase-III site environmental investigations was proposed, which is focused on investigating site feature parameters relating to risk evaluations (such as hydrogeologic parameters of site) and exposure parameters of receptor.

3.6.1. Site Feature Parameter Investigations

Feature parameter investigations of Ganshui site are mainly to investigate the hydrogeologic materials of site in detail. Chongqing Haihang Engineering Investigation and Design Co., Ltd. has undertaken the geological investigation tasks, entered the site for work on March 12, 2014 and completed field work on March 17, 2014. Their main work contents during this period include hydrogeological drilling, field geological investigations, collection and collation of geological materials. The soil core drilling records during the geologic survey are shown in Figure 7.

Figure 7 Drilling Record of Ganshui Site: Fill (left) Rock Core (right)

3.6.1.1. Geologic Structure

The area where Ganshui site is located is placanticline and inclined plane shape medium deep hill with wide and narrow valleys. It is located at the bottom of slope with an angle of slope being 10-25°. Topographic changes are gentle and step-shaped. In general, terrain is relatively simple with single landform.

This site structurally belongs to the east wing of Zhongfeng Temple syncline. There are exposed bedrocks in survey areas, and the bedrocks are made of sandstone and mudstone. In the vicinity with bedrocks, it is found that: the rock formation is subject to a monoclinic output, with an attitude of 280-310°∠5-10°, and the dip of proposed borehole in the formation is 6°. The attitude of rock formation is flat, without any fault structure and with simple geologic structure. The mesh weathered fractures of strongly weathered mudstone formation in the site are developed. In the bedrock revealed by the drilling, it is found that three groups of fractures are developed and the fractures in weathered formation are more developed. Some fracture surfaces have crystals and the structural surfaces are rougher, subject to calcareous cementation. They all belong to the rigid structural surfaces.

3.6.1.2. Formation Lithology

According the field survey and drilling revealed information, the buried depth of site bedrock is approximately 2m. The lateral slope of geotechnical interface inclination is generally 3-10° and the vertical slope is generally3-8°. Stratum of Ganshui site from up to bottom is quaternary system Holocene series artificial soil (Q4ml), residual (Q4el) clay, Jurassic systerm middle Shaximiao Group (J_{2s}) sand and mudstone. The geotechnical properties and characteristics are now described as follows:

(1) Artificial Fill Formation of Quaternary system (Q4ml)

Plain fill: the fill thickness revealed by drilling operation is approximately 1m. The plain fill belongs to fragments of mudstone and sandstone and bricks, with different sizes and mixed composition and loose structure. They are distributed in the whole site, and the landfill retention period is 2-3 years.

(2) Aluvial Formation of Quaternary System (Q4el+dl)

According to the field survey, the general thickness of eluvial formation is 1m or so, subject to gray brown – yellow-brown color, and its lithology is dominated by clay and silty clay and usually in plastic – hard plastic state and widely distributed in bottom of gullies and in slope lots.

(3) Sandstone and mudstone of Shaximiao formation of middle Jurassic system (J_{2s})

The thickness of strongly weather formation is usually 1.3-1.8 m, of which, the strongly weather mudstone formation mostly displayed the chunky and flaky shape. Moderately weathered bedrock mostly displayed the columnar shape and its fracture is more developed, with more complete rock body and hard rock mass and its fragment length is generally 5-20 cm. The occurrence of the rock formation intends to Northwest (280-310°), with a dip angle of 5-10° or so. The buried depth of this formation is shallower, generally 1 m or so.

3.6.1.3. Hydrogeololgy

The survey and exploration results of Ganshui Site show that the groundwater is classified into loose soil pore water and bedrock fissure water. Among these, bedrock fissures are developed well and small quantities of crystals are found on the fissure surface. Area where Ganshui site is located is mainly represented by bedrock fissure water and the distance from stable water level to aperture is about 10.50 m.

Establishing underground water monitoring well, collecting non-disturbed columned sample of soil and conducting geotechnical test may provide data for evaluating site risks and further confirming whether underground water of Ganshui site is polluted or not;

(1) Groundwater monitoring well

In combination with the requirements of Technical Specification for Environmental Site Investigations and the technical guidelines of site environmental risk assessment, at least one groundwater monitoring well shall be set up in the groundwater upper/lower reaches and contaminated areas in this site. As building of Ganshui site is not dismantled, its underground water monitoring well is set as follows: underground water #1 point location is determined to be existing underground water well of national grid at Ganshui Town (well is about 40m deep and underground water level is about 20 m); underground water #2 is set 20 m away from Ganshui site, which is lower than Ganshui site by 2 m in the aspect of terrain. Sampling layout of underground water is shown in Figure 8.

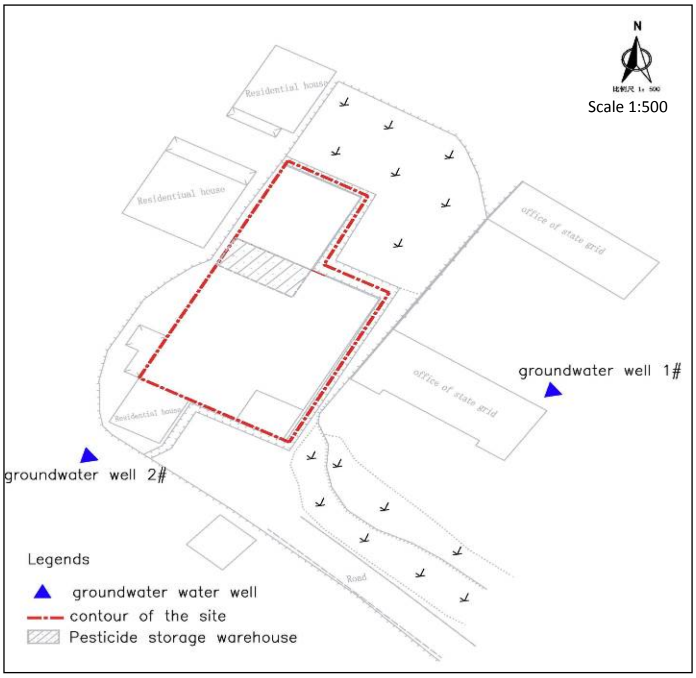

Figure 8 Layout of Underground Water Monitoring Well

(2) Depth of monitoring wells

Underground water monitoring well is 50 cm below the bottom plate of water-bearing stratum or 5 m below the water level of aquifer, but shall not penetrate through aquiclude. In the absence of hydrologic data of Ganshui site, buried depth of its underground water may vary with relative relief greatly and monitoring well of Ganshui site is proposed to be 2 m below the initial water level.

(3) Construction of monitoring wells

SH-30 type drilling rig is used for the drilling of monitoring wells. The diameter of drill bit open pore and sleeve is 127mm and 150mm respectively for filling in sand gravel and hole sealing clay or bentonite. The specific sequence for building monitoring well is as follows:

- After the required depth of monitoring well is drilled, remove slurry and sediment in the drill and then calibrate hole depth before putting the tube based on PVC water pipe, determine pipe depth, length and installation position of filter pipe;
- After completing the trip-in operation of well tubes, the helicopter is used to lift the string straight and centralize and fix it at the opening to ensure it is concentric with the borehole.
- The sand guide tube is used to slowly input the filtering media into the ring gap between tube wall and well wall.
- According to actual conditions of Ganshui site, fill bentonite at water-resisting layer or aquitard from 50 cm below filter materials to 50 cm above filter materials, use water pipes to inject little water to drill hole evenly for every 10 cm backfilling so as to prevent the adhesion of bentonite, well casing and sleeving during the backfilling of bentonite and water injection stabilization.

(4) Washing of monitoring wells

Use Bailer pipe to flush the well for the first time with more than 10 times volume of well capacity; leave it for 3 days after the first well flushing, conduct the second well flushing and measure water level with at least 3-5 times volume of well capacity; when field water quality monitoring parameters (pH, electrical conductivity, water temperature, turbidity, dissolved oxygen, etc.) become stable gradually, collect samples of underground water.

(5) Collection, preservation and transfer of groundwater

The Bailer pipes are used to collect the groundwater. The volume of collected groundwater shall not be less than 1 L. The water sample shall be poured into preservative-containing brown sample bottles and the bottles shall be placed into the temperature incubator (4 ℃) with blue ices. The transfer of groundwater samples shall refer to the transfer of soil samples.

The determination items of groundwater samples are the same as the soil samples, mainly including, organic chlorinated pesticides, arsenic, mercury and lead.

3.6.1.4. Conclusions of Geology and Hydrology

In the geological investigations of Ganshui site, relative elevation and depth of drill hole is 152.89 m and 36.40 m respectively; overburden layer is about 1.0 m thick and hypogastrium bedrock is sand-mudstone. According to rock core revealed by drill hole, it is found that bedrock fissure is developed well and bedrock fissure water is mainly buried in the upper Shaximiao group (J_{2s}) grey white and white sandstone. Fissure in the sandstone is the space for transferring and storing underground water. The drilling records are detailed in Annex 10 (Geological bore record of Ganshui site).

As shown in Table 11, no target contaminant (mainly including BHCs and DDTs in organic chlorinated pesticide) was detected in the groundwater, and the contaminants including chloroform were detected in the groundwater of point 1#, which doesn’t matter much with the warehouse’s stacking of insecticides or pesticides.

Table 11 Determination Results of Groundwater Samples (μg/L)

Description	pH	α-BHC	γ-BHC	β-BHC	δ-BHC	DDE	DDD	DDT	CH_3Cl	$C_2H_4Cl_2$	Chloroform	Bromodichloromethane	Dibromochloromethane	Pb	As	Hg
1#	7.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	2.7	0.9	3.4	1.5	1.2	<1	<5	<0.1
2#	6.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<5	<0.1

3.6.2. Investigations of Contamination Characteristics of Buildings

It is revealed by site investigations that Ganshui site is contaminated by BHC pesticides, which confirmed that the warehouse has previously been used for storing BHC pesticide, and the pesticide powder is likely to settle and become attached to the wall surface. Similar domestic cases also proved that building walls are polluted by pesticides. Therefore, samplings of walls and ground at pesticide warehouses are required at the phase-III investigation work of Ganshui site.

Currently, Ganshui site is unoccupied and declared by the owner as dilapidated building for management. From the perspective of its structural safety, the existing building of Ganshui site is unsuitable for living. Therefore, the evaluation methods of health risks adopted for recycling of contaminated buildings are not applicable; instead, identification standards of dangerous wastes shall be used for its evaluation. If standards of dangerous wastes are not reached, soil on the surface layer of wall may be deemed as contaminated soil for treatment.

3.6.2.1. Survey Program for Contamination of Buildings

(1) Sampling layout

Samples are collected at the area with obvious pollution stains at the interior wall and ground of pesticide warehouse. According to the principle of average sampling layout, 8 samples are collected on the surface of warehouse wall (3 samples are collected at different areas for long wall space while 1 sample is collected for short wall) and 3 samples are collected on the ground. Refer to Figure 9 for sampling layout.

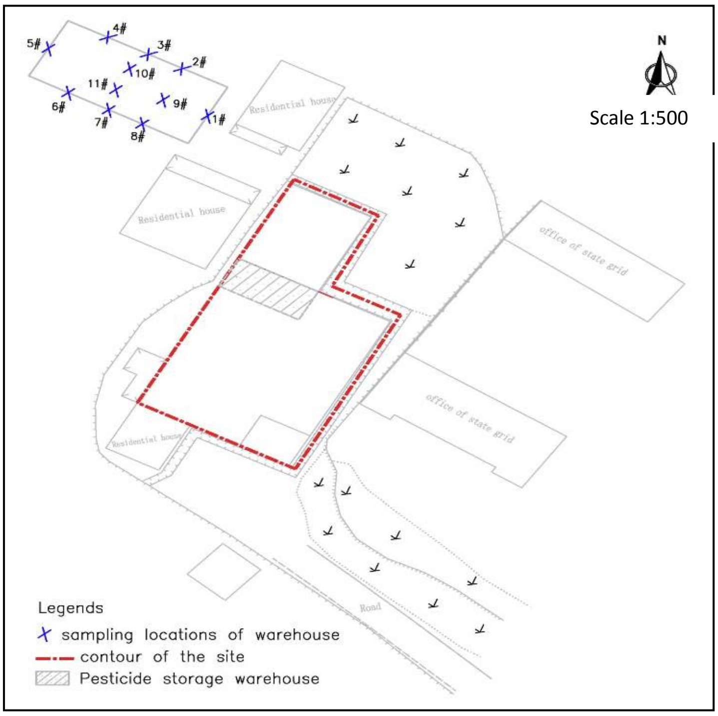

Figure 9 Sampling Layout of Buildings at Ganshui Site

(2) Collection of samples of buildings

Wall: A layer of lime mortar is plastered on the wall surface of Ganshui warehouse. Three samples of the same amount are collected at the height of 1.5 m, 0.8 m and 0m on the wall surface perpendicular to the ground horizontal line. The collected depth of the samples is 0-5 cm. The quartering method is used and the collected amount shall not be less than 100 kg.

Ground: the ground floor of Ganshui warehouse is the hardened concrete. The sampling pickaxe or shovel can be used to break the ground and mix the broken concrete and then the quartering method is used to collect the samples. The collected amount of the samples shall not be less than 100 g.

The main contaminants of structure samples are the organic chlorinated pesticides, thus, the preservation and transfer of the samples shall be carried out in accordance with the soil samples.

(3) Collection of samples of buildings

- Contaminant determination: main contaminants of the samples are organic chlorinated pesticides. ☐
- Toxicity test: for the surface samples that were contaminated by the organic chlorinated pesticides after confirmation, Solid Waste-Extraction Procedure for Leaching Toxicity-Sulphuric Acid & Nitric Acid Method (HJ/T299) shall be used to carry out the leaching toxicity test and evaluation of the building wastes so as to determine whether or not they shall be disposed as the hazardous wastes.☐

3.6.2.2. Analyses Results of Samples of Buildings

The determination results of pesticide warehouse wall and ground at Ganshui site are shown in Table 12 and test results of its leaching toxicity are shown in Table 13.

Table 12 Examination Results of Samples of Buildings (mg/kg)

Item	1#	2#	3#	4#	5#	6#	7#	8#	9#-1	10#-1	11#-1

α-BHC	nd	nd	nd	nd	0.02	0.02	nd	nd	0.05	nd	0.13
γ-BHC	nd	nd	nd	nd	nd	0.01	nd	nd	nd	nd	0.14
β-BHC	nd	0.02	0.05	nd	**1.83**	**0.29**	0.07	0.01	**0.35**	0.04	**2.33**
δ-BHC	nd	nd	nd	nd	0.04	0.02	nd	nd	nd	nd	0.08
BHCs	nd	0.02	0.05	nd	**1.89**	0.34	0.07	0.01	0.40	0.04	**2.68**
o, p'-DDE	nd	nd	nd	nd	0.02	0.01	nd	nd	nd	nd	nd
p, p'-DDE	nd	nd	0.01	nd	0.05	nd	nd	nd	0.01	0.01	0.11
o, p '-DDT	nd	nd	nd	nd	0.11	nd	nd	nd	nd	nd	nd
p, p'-DDT	nd	0.01	0.02	nd	0.04	0.03	nd	nd	0.01	nd	0.43
DDTs	nd	0.01	0.03	nd	0.22	0.04	nd	nd	0.02	0.01	0.54

- 9#-1, 10#-1 and 11#-1 all refer to the substances of ground hardened layer (within 3cm) corresponding to soil sampling points 9#, 10# and 11#;
- Detection limit of o,p'-DDE, p,p'-DDE, o,p‘-DDT, p,p'-DDT, α-BHC, γ-BHC, β-BHC and δ-BHC is 0.01 mg/kg; nd means that it is not detected;

Table 13 Leaching Test Results of Samples of Buildings (μg/L)

Item	2#	3#	5#	6#	7#	8#	9#-1	10#-1	11#-1
α-BHC	nd	0.2	0.5	0.5	0.2	nd	0.8	nd	0.3
γ-BHC	nd	0.2	0.1	0.2	nd	nd	nd	nd	0.2
β-BHC	1.0	2.3	21.2	12.1	1.9	0.5	3.0	0.7	11.0
δ-BHC	0.1	0.2	0.4	0.3	nd	nd	nd	nd	0.2
BHCs	1.1	2.9	22.2	13.1	2.1	0.5	3.8	0.7	11.7
o, p'-DDE	nd	nd	nd	nd	nd	nd	nd	nd	nd
p, p'-DDE	nd	nd	nd	nd	nd	nd	nd	nd	nd
o, p '-DDT	nd	nd	nd	nd	nd	nd	nd	nd	nd
p, p'-DDT	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDTs	nd	nd	nd	nd	nd	nd	nd	nd	nd

Note: In the leaching agent, detection limit of o,p'-DDE, p,p'-DDE, o,p'-DDT, p,p'-DDT, α-BHC, γ-BHC, β-BHC and δ-BHC is 0.1 μg/L; nd means that it is not detected.

(2) Analysis of sample result of buildings (structures)

As shown in Table 12, the levels of α-BHC, γ-BHC, β-BHC and δ-BHC in the structures samples (wall surface and ground hardened layer) are among nd-0.13 mg/kg, nd-0.14 mg/kg, nd-2.33 mg/kg and nd-0.08 mg/kg, respectively, and the total level of BHCs is among nd-2.68 mg/kg and its maximum level occurs in Point 11# of ground samples.

DDT of buildings or structures are detected to a varying degree: o,p'-DDE is only detected in 2 samples (with total 11 samples) with maximum value being 0.02 mg/kg; p,p'-DDE is only detected in 5 samples (with total 11 samples) with maximum value being 0.11 mg/kg; o,p'-DDT is only detected at 5# point with its contents being 0.11 mg/kg; p,p'-DDT of buildings or structures are detected in 6 samples with maximum value being 0.43 mg/kg; DDT contents of buildings or structures vary between nd~0.54 mg/kg. Similarly, its maximum value also occurs in the ground 11# point.

It is shown by the said detection results that wall and ground of pesticide warehouse at Ganshui site are obviously polluted by BHC pesticides and main pollution way is pesticide leakage or adhesion and sedimentation along with dust. However, it is shown by test results of leaching toxicity of structure samples (Table 13) that leaching concentration of all samples BHCs (0.5~22.2 μg/L) is generally less than the standard limiting value (0.5 mg/L) specified in the Identification Standards of Hazardous Wastes-Identification of Leaching Toxicity (GB 5058.3 -2007). And the fact that DDTs are not detected shows that contaminated buildings or structures do not reach the standards of hazardous wastes and may be treated as contaminated soil.

3.6.3. Receptor Exposure Parameter Investigations

According to Construction planning of Ganshui Town, Qijiang County (2003-2020), Ganshui site is planned to be residential land in the future. If its contaminated soil is not remediated well, residents living in it may encounter health risks caused by contact with contaminated soil for a long time. Tolerable daily soil intake, skin contact area, exposure cycle and frequency, etc., are mainly considered for exposure features of receptor. As exposure parameter value of local population has not been released by Chongqing Municipality currently, it is adequate to refer to Technical Guidelines for Environment Risks Evaluation of Contaminated Site (HJ25.3-2014) released by Ministry of Environmental Protection for determining the relevant exposure parameter values of Ganshui site.

4. Environmental Risk Assessment and Remediation Objectives Determination

4.1. Workflow for Risk Assessment

Ganshui site environment risks are mainly evaluated by reference to Technical Guidelines for Environment Risks Evaluation of Contaminated Site (HJ25.3-2014) released by the Ministry of Environmental Protection. Please refer to Figure 10 for specific working process.

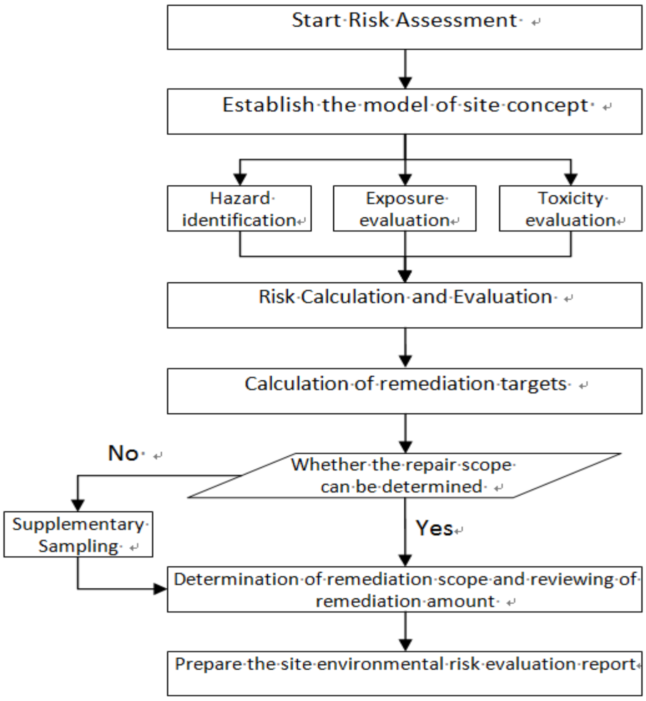

Figure 10 Flow Chart of Site Risk Assessment

4.2. Model of Site Concept

The main purpose of building a model of site concept is to identify the routes of site contamination, the laws of pollutants immigration, and the pathways of receptor exposure and characteristics of exposure. According to preliminary site investigation results, soil at 0-1.5 m of Ganshui site is backfilled earth while soil below 1.5 m is mainly weathered bedrock.

Underground water is preliminarily observed at 7.6 m depth. Arsenic, α-BHC and β-BHC target pollutants are mainly distributed at 0-0.4 m layer and some sampling points may be contaminated with 1.5 m depth. In addition, the underground water beneath Ganshui site has not been polluted. Therefore, contaminated topsoil is the source of health risk of Ganshui site. By combining with historical use of Ganshui site, it is presumed that its main pollution ways are leakage of pesticide during the loading and unloading process or leakage caused by container breakage. BHC and arsenic are pollutants that are hard to undergo biodegradation. If its contaminated soil is not remediated, it may pose long-term health risks to residents living in it in the future.

According to distribution of site pollutants and hydrogeological structure, 0-1.5 m soil may be generalized to one conceptual layer and used as risk source of receptor for the future risk prediction. Ganshui site is planned to be residential land and its site exposure model is shown in Figure 11. Main exposure routes are false ingestion through mouth (namely oral administration), adhesion of contaminated soil to exposed skin and penetration into human body (skin contact), inhalation of dust containing pollutants and gaseous pollutants volatilized into the air (inhalation by breathing), which are consistent with exposure features of receptor under typical residential circumstances. Take the recommended values directly from the Technical Directive for Risk Evaluation of Contaminated Site issued by the Ministry of Environmental Protection (MEP) for parameter selection of relevant receptor exposure characteristics.

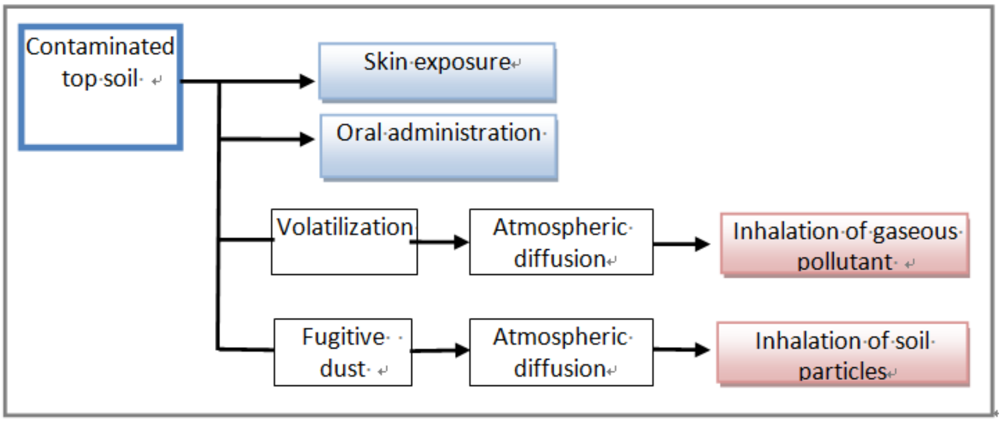

Figure 11 Conceptual Model of Exposure

4.3. Hazard Identification

Therefore, it is necessary for Ganshui site to list them as pollutants for further risk analysis. After the phase I and phase II site investigations, pollutants exceeding screening values are mainly α-BHC, β-BHC, γ-BHC and arsenic. Its exposure concentration is determined to be 95% confidence upper limit of average value of samples detection results. Its statistical results are shown in Table 14.

Table 14 Statistical Findings of Exposure Concentration (mg/kg)

Pollutant	As	α-BHC	β-BHC	γ-BHC
Exposure concentration	70.1	0.66	2.14	0.18

4.4. Toxicity Evaluation

For toxicity of pollutants, adverse reaction caused by pollutants to human body is generally represented by dosage-response relationship. Dangers that may be caused for human health can be divided into two types: carcinogens risks and non-carcinogens risks. These two kinds of risks shall be calculated at the health risk evaluation of contaminated sites concurrently and only the most conservative result is adopted.

A non-carcinogenic risk means one that a toxic and harmful substance has to reach a minimum dosage (i.e. threshold) before harming the human body; otherwise it will not cause any detectable hazard upon human health. Hazard entropy is a quantity evaluation index for single non-carcinogenic risk, i.e. the ratio of concentration to threshold. When the ratio is greater than 1, it is deemed that the concentration has reached the edge of harming the human body, requiring actions against it. The sum of the hazard entropies of multiple harmful substances passing the same route or of a single harmful substance passing multiple routes of exposure is called hazard index.

The carcinogenic risk features: It is believed that even a very small amount of dose taken will produce certain harm upon human health, which may develop from initial molecular biological level into a clinic pathological change longtime later. Generally, the quantification index of carcinogenic risks on contaminated sites is slope coefficient. Mainly aiming at first-grade and grade B carcinogens, slope coefficient reflects a quantitative relation between intake concentration and carcinogenic risk. The product of the coefficient and the amount of intake is called carcinogenic risk value (usually known as risk value for short).

Carcinogenic risk slope factor (SF) and chronic toxicity reference dose (RfDo) are respectively necessary parameters in calculating risk value and hazard entropy. The toxicity parameters of Ganshui site target pollutants were directly quoted from the reported values in the U. S. EPA risk information system, and were modified on basis of our country's human weight and respiratory capacity as shown in Table 15.

Table 15 Toxicity Parameters of Target Contaminants

No.	Pollutant		Carcinogenic risk slope factor SF[mg/(kg·d)]$^{-1}$			Chronic toxicity reference dosage RfD$_o$mg/(kg·d)]		
	Name	CAS code	Intake via mouth SF$_o$	Skin contact SF$_d$	Inhalation intake SF$_i$	Intake via mouth RfD$_o$	Skin contact RfD$_d$	Inhalation intake RfD$_i$
1	As	7440-38-2	1.50	1.50	15.05	3.00E-04	3.00E-04	5.25E-05
2	α-BHC	319-84-6	6.30	6.30	6.3	8.00E-03	8.00E-03	/
3	β-BHC	319-85-7	1.80	1.80	4.86	/	/	/
4	γ-BHC	58-89-9	1.10	1.10	1.09	3.00E-04	3.00E-04	/

Note: "/" indicates that the data thereof have not been listed.

4.5. Risk Calculation and Evaluation

The purposes of risk characterization are, first of all, to calculate exposure dose of receptor pollutants depending on pollutant exposure concentration and characteristics of receptor exposure, then to calculate and quantify the receptor health risks on basis of pollutant toxic properties by using dose-effect model.

4.5.1. Computational Formula of Risk Assessment

Site health risks can be analyzed by the amount of local residents' intake of soil pollutants after target pollutants on the site are identified. As seen in the analysis of exposure routes in this section, this Evaluation selected the mode of soil exposure to be land for residential use, and described 5 routes of exposure: intake via mouth, skin contact of soil, inhalation of soil particles, inhalation of gaseous pollutants in the outdoor air coming from soil and inhalation of gaseous pollutants in the indoor air coming from soil.

Computational formula for exposure dose, carcinogenic risk and hazards of single pollutant as well as carcinogenic risk of all pollutants and non-carcinogenic hazard indexes are depicted in the following.

(1) Calculation of exposure dose

1) Route of soil intake via mouth

Carcinogenic effect of single pollutants, considering lifelong hazard upon population during their childhood and adulthood. Using formula [1] to calculate the amount of soil exposure corresponding to the route of soil intake via mouth:

$$OISERca = \frac{\left(\frac{OSIRc \times EDc \times EFc}{BWc} + \frac{OSIRa \times EDa \times EFa}{BWa}\right) \times ABSo}{ATca} \times 10^{-6} \qquad [1]$$

Where:

OISERca – Amount of exposure of soil intake via mouth (carcinogenic effect): *kg soil•kg*$^{-1}$*•body weight•d*$^{-1}$

OSIRc – Daily amount of soil intake of child, *mg•d*$^{-1}$;

OSIRa – Daily amount of soil intake of adults, *mg•d*$^{-1}$;

EDc – Child exposure cycle, *a*;

EDa – Adult exposure cycle, *a*;

EFc – child exposure frequency, *d•a*$^{-1}$;

EFa – Adult exposure frequency, *d•a*$^{-1}$;

BWc – Child weight, kg;

BWa – Adult weight, kg;

ABSo – Absorption efficiency factor of intake via mouth, dimensionless;

ATca – Average time of carcinogenic effect, d.

Non-carcinogenic effect of single pollutants, considering hazard upon population during their childhood. Using formula [2] to calculate the amount of soil exposure corresponding to the route of soil intake via mouth:

$$\mathrm{OISER}nc = \frac{OSIRc \times EDc \times EFc \times ABSo}{BWc \times ATnc} \times 10^{-6} \qquad [2]$$

Where:

OISERnc – Amount of exposure of soil intake via mouth (non-carcinogenic effect): *kg soil•kg*$^{-1}$*•body weight•d*$^{-1}$;

ATnc – Average time of non-carcinogenic effect, d.

See formula [1] for parameter meanings of OSIRc, Edc, Efc, BWc and ABSo in formula [2].

2) Route of skink contact of soil

Carcinogenic effect of single pollutants, considering lifelong hazard upon population during their childhood and adulthood. Using formula [3] to calculate the amount of soil exposure corresponding to the route of skink contact of soil:

$$DCSERca = \frac{SAEc \times SSARc \times EFc \times EDc \times Ev \times ABSd}{BWc \times ATca} \times 10^{-6} + \frac{SAEa \times SSARa \times EFa \times EDa \times Ev \times ABSd}{BWa \times ATca} \times 10^{-6} \quad [3]$$

Where:

DCSER*ca* – Amount of soil exposure by skin contact (carcinogenic effect): *kg soil•kg*$^{-1}$*•body weight•d*$^{-1}$;

SAE*c* – Skin surface area of child exposure, *cm*^{2};

SAE*a* – Skin surface area of adult exposure, *cm*^{2};

SSAR*c* – Soil sticking coefficient of child skin surface, *mg·cm*$^{-2}$;

SSAR*a* – Soil sticking coefficient of adult skin surface, *mg·cm*$^{-2}$;

ABS*d* – Absorption efficiency factor of skin contact, dimensionless;

Ev – Event frequency of daily skin contact, *d*$^{-1}$;

For parameter meanings of EFc, EDc, BWc, EFa, EDa, BWa and ATca in formula [3] see formula [1]. For those of SAEc and SAEa see formulas [4] and [5]:

$$SAEc = 239 \times Hc^{0.417} \times BWc^{0.517} \times SERc \quad [4]$$

$$SAEa = 239 \times Ha^{0.417} \times BWa^{0.517} \times SERa \quad [5]$$

Where:

Hc – Average children height, *cm*;

Ha – Average adult height, *cm*;

SERc – Ratio of child exposed skin area to the total area, dimensionless;

SERa – Ratio of adult exposed skin area to the total area, dimensionless;

See formula [1] for parameter meanings of BWc and BWa in formula [4] and formula [5].

Non-carcinogenic effect of single pollutants, considering hazard upon population during their childhood. Using formula [6] to calculate the amount of soil exposure corresponding to the route of skink contact of soil:

$$DCSERnc = \frac{SAEc \times SSARc \times EFc \times EDc \times Ev \times ABSd}{BWc \times ATnc} \times 10^{-6} \quad [6]$$

Where:

DCSERnc – Amount of soil exposure by skin contact (non-carcinogenic effect):

For parameter meanings of SAEc, SSARc, Ev and ABSd in formulas [6] and see formulas [3]. For those of EFc, EDc and BWc see formula [1]. For that of ATnc see formula [2].

3) Route of Inhaled soil particles

Carcinogenic effect of single pollutants, considering lifelong hazard upon population during their childhood and adulthood. Using formula [7] to calculate the amount of soil exposure corresponding to the route of inhaled soil particles:

$$\mathrm{PISER}ca = \frac{PM10 \times DAIRc \times EDc \times PLAF \times (fspo \times EFOc + fspi \times EFIc)}{BWc \times ATca} \times 10^{-6} + \frac{PM10 \times DAIRa \times EDa \times PLAF \times (fspo \times EFOa + fspi \times EFIa)}{BWa \times ATca} \times 10^{-6} \quad [7]$$

Where:

PISERca – Amount of exposure of soil of inhaled soil particles (carcinogenic effect): *kg soil•kg*$^{-1}$*•body weight•d*$^{-1}$;

PM10 – Content of inhaled particles in the air, $mg{\cdot}m^{-3}$;

DAIRa – Daily respiratory capacity of adult, $m^{3}{\cdot}d^{-1}$;

DAIRc – Daily respiratory capacity of child, $m^{3}{\cdot}d^{-1}$;

PLAF – Proportion of inhaled soil particles left in the human body, dimensionless;

fspi – Proportion of particles in the indoor air coming from soil, dimensionless;

fspo – Proportion of particles in the outdoor air coming from soil, dimensionless;

EFIa – Adult indoor exposure frequency, $d{\cdot}a^{-1}$;

EFIc – Child indoor exposure frequency, $d{\cdot}a^{-1}$;

EFOa – Adult outdoor exposure frequency, $d{\cdot}a^{-1}$;

EFOc – Child outdoor exposure frequency, $d{\cdot}a^{-1}$;

See formula [1] for parameter meanings of Edc, BWc, Eda, BWa and ATca in formula [7] .

Non-carcinogenic effect of single pollutants, considering hazard upon population during their childhood. Using formula [8] to calculate the amount of soil exposure corresponding to the route of inhaled soil particles

$$\text{PISER}n\text{c} = \frac{PM10 \times DAIRc \times EDc \times PLAF \times (fspo \times EFOc + fspi \times EFIc)}{BWc \times ATnc} \times 10^{-6} \qquad [8]$$

Where:

PISERnc – Amount of exposure of soil of inhaled soil particles (non-carcinogenic effect), kg soil•kg^{-1}•body weight•d^{-1};

For parameter meanings of PM10, DAIRc , fspo, fspi, EFOc, EFIc and PLAF in formula [8] and see formula [7]. For those of Edc, BWc, EDa and BWa see formula [1]. For that of ATnc see formula [2].

4) Route of inhaling gaseous pollutants in the outdoor air

Carcinogenic effect of single pollutants, considering lifelong hazard upon population during their childhood and adulthood. Using formulas [9] and [10] to calculate the amount of soil exposure corresponding to gaseous pollutants in the inhaled outdoor air respectively from site topsoil and subsoil:

$$IoVERca1 = VF_{suroa} \times \left(\frac{DAIRc \times EFOc \times EDc}{BWc \times ATca} + \frac{DAIRa \times EFOa \times EDa}{BWa \times ATca} \right) \qquad [9]$$

$$IoVERca2 = VF_{suboa} \times \left(\frac{DAIRc \times EFOc \times EDc}{BWc \times ATca} + \frac{DAIRa \times EFOa \times EDa}{BWa \times ATca} \right) \qquad [10]$$

Where:

*IoVERca*1 – The amount of soil exposure (carcinogenic effect) corresponding to gaseous pollutants in the inhaled outdoor air coming from topsoil, *kg soil•kg*$^{-1}$*•body weight•d*$^{-1}$;

*IoVERca*1 – The amount of soil exposure (carcinogenic effect) corresponding to gaseous pollutants in the inhaled outdoor air coming from subsoil, *kg soil•kg*$^{-1}$*•body weight•d*$^{-1}$;

VFsuroa – The content of soil in the outdoor air corresponding to volatilized pollutants in topsoil, kg•m^{-3}; calculating according to formula [11];

VFsuboa – The content of soil in the outdoor air corresponding to volatilized pollutants in subsoil, kg•m^{-3}; calculating according to formula [12];

For parameter meanings of DAIRc, DAIRa, EFOc, EFOa, EFIc and EFIa see formula [7]. For those of EDc, BWc, EDa, BWa, ATca see formula [1].

$$VF_{suroa} = MIN(VF_{suroa-1}, VF_{suroa-2}) \qquad [11]$$

$$VF_{suboa} = \frac{H' \times \rho_b}{(\theta_{avs} \times H' + \theta_{wvs} + K_{oc} \times f_{oc} \times \rho_b) \times \left(1 + \frac{U_{air} \times \delta_{air} \times L_s}{D_s^{eff} \times W_{dw}}\right)} \times 10^3 \qquad [12]$$

$$VF_{suroa-1} = \frac{2W_{dw} \times \rho_b}{U_{air} \times \delta_{air}} \sqrt{\frac{D_s^{eff} \times H'}{3.141 \times (\theta_{avs} \times H' + \theta_{wvs} + K_{oc} \times f_{oc} \times \rho_b) \times \tau}} \times 10^3 \qquad [13]$$

$$VF_{suroa-2} = \frac{W_{dw} \times \rho_b \times d}{U_{air} \times \delta_{air} \times \tau} \times 10^3 \qquad [14]$$

Wherein:

VFsuroa-1 – The content (algorithm 1) of soil in the outdoor air corresponding to volatilized pollutants in topsoil, kg·m^{-3};

VFsuroa-2 – The content (algorithm 2) of soil in the outdoor air corresponding to volatilized pollutants in topsoil, kg·m^{-3};

Vf_{suroa} – The content (the lower value between algorithm 1 and algorithm 2) of soil in the outdoor air corresponding to volatilized pollutants in topsoil, kg·m^{-3};

W_{dw} – Length of soil contaminated area parallel to the prevailing wind direction, cm;

U_{air} – Average annual wind speed of atmosphere of near-surface in soil contaminated area, cm/s;

δ_{air} – Atmospheric mixed layer height of near-surface of soil polluted area, cm;

f_{oc} – Fraction of soil organic carbon mass, dimensionless;

K_{oc} – Distribution coefficient of soil organic carbon / soil pore water, L·kg^{-1};

τ– Duration of gaseous pollutant invasion, s;

d – Thickness of surface contaminated soil layer, cm; parameter values must be obtained from site investigation findings.

ρ_b – Soil volume weight

D_s^{eff} – Effective dispersion coefficient of gaseous pollutants in soil, cm^2.s^{-1};

θ – Volume ratio of total pore space in unsaturated topsoil, dimensionless;

θ_{avs} – Volume ratio of pore air in unsaturated topsoil, dimensionless;

θ_{wvs} – Volume ratio of pore water in unsaturated topsoil, dimensionless;

Non-carcinogenic effect of single pollutants, considering hazard upon population during their childhood. Using formulas [15] and [16] to calculate the amount of soil exposure corresponding to gaseous pollutants in the inhaled outdoor air respectively from site topsoil and subsoil:

$$IoVERnc1 = VF_{suroa} \times \frac{DAIRc \times EFOc \times EDc}{BWc \times ATnc} \qquad [15]$$

$$IoVERnc2 = VF_{suboa} \times \frac{DAIRc \times EFOc \times EDc}{BWc \times ATnc} \quad [16]$$

Where:

$IoVERnc1$ – The amount of soil exposure (non-carcinogenic effect) corresponding to gaseous pollutants in the inhaled outdoor air coming from topsoil, kg soil•kg^{-1}•body weight•d^{-1};

$IoVERnc2$ – The amount of soil exposure (non-carcinogenic effect) corresponding to gaseous pollutants in the inhaled outdoor air coming from subsoil, kg soil•kg^{-1}•body weight•d^{-1};

For parameter meanings of VFsuroa and VFsuboa in formulas [15] and [16] see formulas [9] and [10]. For those of DAIRc and EFOc see formula [7]. For those of EDc and BWc see formula [1].

5) Route of inhaling gaseous pollutants in the indoor air

Carcinogenic effect of single pollutants, considering lifelong hazard upon population during their childhood and adulthood. Using formula [17] to calculate the amount of soil exposure corresponding to gaseous pollutants in the inhaled indoor air coming from subsoil:

$$IiVERca1 = VF_{subia} \times \left(\frac{DAIRc \times EFIc \times EDc}{BWc \times ATca} + \frac{DAIRa \times EFIa \times EDa}{BWa \times ATca} \right) \quad [17]$$

Where:

$IiVERca1$ – The amount of soil exposure (carcinogenic effect) corresponding to gaseous pollutants in the inhaled indoor air coming from subsoil, kg soil•kg^{-1}•body weight•d^{-1};

VF$_{subia}$ – The content of soil in the indoor air corresponding to volatilized pollutants in subsoil, kg•m^{-3}; calculating according to formula [18];

$$VF_{subia} = \frac{\dfrac{H' \times \rho_b}{\theta_{avs} \times H' + \theta_{wvs} + K_{oc} \times f_{oc} \times \rho_b} \times \dfrac{D_s^{eff} / L_s}{ER \times L_B}}{1 + \dfrac{D_s^{eff} / L_s}{ER \times L_B} + \dfrac{D_s^{eff} / L_s}{D_{crack}^{eff} / L_{crack} \times \eta}} \times 10^3 \quad [18]$$

Where:

VF$_{subia}$ – The content 1 of soil in the indoor air corresponding to volatilized pollutants in subsoil, kg·m^{-3};

ER-Rate of indoor air exchange, times•s^{-1};

L$_B$ – Ratio of indoor air volume to vapor infiltration area, cm;

L$_{crack}$ – Thickness of indoor foundation, cm;

η – Proportion of foundation and wall fissure surface area, dimensionless;

Non-carcinogenic effect of single pollutants, considering hazard upon population during their childhood. Using formula [19] to calculate the amount of soil exposure corresponding to gaseous pollutants in the inhaled indoor air coming from subsoil:

$$IiVERnc1 = VF_{subia} \times \frac{DAIRc \times EFIc \times EDc}{BWc \times ATnc} \quad [19]$$

Where:

$IiVERnc1$ – The amount of soil exposure (non-carcinogenic effect) corresponding to gaseous pollutants in the inhaled indoor air coming from subsoil, kg soil•kg^{-1}•body weight•d^{-1};

For parameter meanings of VFsubia in formula [19] see formula [17]. For those of EFIc see formula [7]. For those of ATnc see formula [2]. For those of EDc and BWc see formula [1].

(2) Carcinogenic risks of single pollutants

For single pollutants calculate their carcinogenic risks through routes of: soil intake via mouth, skin contact of soil, inhalation of soil particles, inhalation of gaseous pollutants in the outdoor air coming from soil, and inhalation of gaseous pollutants in the indoor air coming from soil.

1) Using formula [20] to calculate the carcinogenic risks of single pollutants in soil intake via mouth:

$$\mathrm{CR}_{\mathrm{OIS}} = OISER_{ca} \times C_{sur} \times SF_o \qquad [20]$$

Wherein:

$\mathrm{CR}_{\mathrm{OIS}}$ – Carcinogenic risks of soil intake via mouth exposed to single pollutants, dimensionless;

$\mathrm{C}_{\mathrm{sur}}$ – Concentration of pollutants in topsoil, $mg\bullet kg^{-1}$;

SF_{o} – Carcinogenic slope factor of intake via mouth.

2) Using formula [21] to calculate the carcinogenic risks of single pollutants in soil via skin contact:

$$\mathrm{CR}_{\mathrm{DCS}} = DCSER_{ca} \times C_{sur} \times SF_d \qquad [21]$$

Wherein:

$\mathrm{CR}_{\mathrm{DCS}}$ – Carcinogenic risks of skin contact soil exposed to single pollutants, dimensionless;

$\mathrm{C}_{\mathrm{sur}}$ – Concentration of pollutants in topsoil, $mg\bullet kg^{-1}$;

SF_{d} – Carcinogenic slope factor of skin contact.

3) Using formula [22] to calculate the carcinogenic risks of single pollutants in inhaled soil particles:

$$\mathrm{CR}_{\mathrm{PIS}} = PISER_{ca} \times C_{sur} \times SF_i \qquad [22]$$

Wherein:

$\mathrm{CR}_{\mathrm{PIS}}$ – Carcinogenic risks of inhaled soil particles exposed to single pollutants, dimensionless;

C_{sur} – Concentration of pollutants in topsoil, $mg\bullet kg^{-1}$;

SF_{i} – Carcinogenic slope factor of inhalation.

4) Using formula [23] to calculate the carcinogenic risks of single gaseous pollutants in the inhaled outdoor air:

$$\mathrm{CR}_{\mathrm{IoV}} = \left(IoVER_{ca1} \times C_{sur} + IoVER_{ca2} \times C_{sub}\right) \times SF_i \qquad [23]$$

Wherein:

CR_{IoV} – The risks of the inhaled outdoor air exposed to single pollutants, dimensionless;

$\mathrm{C}_{\mathrm{sub}}$ – Concentration of pollutants in subsoil, $mg\bullet kg^{-1}$.

5) Using formula [24] to calculate the carcinogenic risks of single gaseous pollutants in the inhaled indoor air:

$$\mathrm{CR}_{\mathrm{IiV}} = IiVER_{ca1} \times C_{sub} \times SF_i \qquad [24]$$

Wherein:

CR_{IiV} – The risks of the inhaled indoor air exposed to single pollutants, dimensionless;

C_{sub} – Concentration of pollutants in subsoil, *mg•kg*$^{-1}$.

6) Using formula [25] to calculate the carcinogenic risks of single soil pollutants through all routes of exposure:

$$CR_n = CR_{OIS} + CR_{DCS} + CR_{PIS} + CR_{IoV} + CR_{IiV} \qquad [25]$$

Wherein:

CR_n – Carcinogenic risks of exposure to single pollutants (of the nth kind) through all routes of exposure, dimensionless;

(3) Non-carcinogenic hazard entropy of single pollutants

For single pollutants calculate their non-carcinogenic hazard entropy value through routes of: soil intake via mouth, skin contact of soil, inhalation of soil particles, inhalation of gaseous pollutants in the outdoor air coming from soil, and inhalation of gaseous pollutants in the indoor air coming from soil.

1) Using formula [26] to calculate the non-carcinogenic hazard entropy value of single pollutants in contaminated soil intake via mouth

$$HQ_{OIS} = \frac{OISER_{nc} \times C_{sur}}{RfD_o \times SAF} \qquad [26]$$

Wherein: HQ_{OIS} – Non-carcinogenic hazard entropy value of soil intake via mouth exposed to single pollutants, dimensionless;

C_{sur} – Concentration of pollutants in topsoil, *mg•kg*$^{-1}$;

RfD_o – Reference dosage of intake via mouth;

SAF – Distribution coefficient of reference dose exposed to soil, dimensionless;

2) Using formula [27] to calculate the non-carcinogenic hazard entropy value of single pollutants in contaminated soil via skin contact:

$$HQ_{DCS} = \frac{DCSER_{nc} \times C_{sur}}{RfD_d \times SAF} \qquad [27]$$

Wherein: HQ_{DCS} – Non-carcinogenic hazard entropy value of soil via skin contact exposed to single pollutants, dimensionless;

C_{sur} – Concentration of pollutants in topsoil, *mg•kg*$^{-1}$;

RfD_d – Reference dose of skin contact;

SAF – Distribution coefficient of reference dose exposed to soil, dimensionless;

3) Using formula [28] to calculate the non-carcinogenic hazard entropy value of single pollutants in inhaled polluted soil particles:

$$HQ_{PIS} = \frac{PISER_{nc} \times C_{sur}}{RfD_i \times SAF} \qquad [28]$$

Wherein: HQ_{PIS} – Non-carcinogenic hazard entropy value of single pollutants in inhaled polluted soil particles, dimensionless;

C_{sur} – Concentration of pollutants in topsoil, *mg•kg*$^{-1}$;

RfD_i – Reference dose of inhaled polluted soil particles;

SAF – Distribution coefficient of reference dose exposed to soil, dimensionless;

4) Using formula [29] to calculate the non-carcinogenic hazard entropy value of single gaseous pollutants in the inhaled outdoor air:

$$\mathrm{H}Q_{\mathrm{IoV}} = \frac{IoVER_{nc1} \times C_{sur} + IoVER_{nc2} \times C_{sub}}{RfD_i \times SAF} \qquad [29]$$

Wherein: HQ_{IoV} – Non-carcinogenic hazard entropy value of inhaled outdoor air exposed to single pollutants, dimensionless;

5) Using formula [30] to calculate the non-carcinogenic hazard entropy value of single gaseous pollutants in the inhaled indoor air:

$$\mathrm{H}Q_{\mathrm{IiV}} = \frac{IiVER_{nc1} \times C_{sub}}{RfD_i \times SAF} \qquad [30]$$

Wherein: HQ_{IiV} – Non-carcinogenic hazard entropy value of inhaled indoor air exposed to single pollutants, dimensionless;

6) Using formula [31] to calculate the non-carcinogenic hazard entropy value of single soil pollutants through all routes, dimensionless:

$$\mathrm{H}Q_{\mathrm{n}} = \mathrm{H}Q_{\mathrm{OIS}} + \mathrm{H}Q_{\mathrm{DCS}} + \mathrm{H}Q_{\mathrm{PIS}} + \mathrm{H}Q_{\mathrm{IoV}} + \mathrm{H}Q_{\mathrm{IiV}} \qquad [31]$$

Wherein: $\mathrm{H}Q_n$ – Non-carcinogenic hazard indexes of exposure to single pollutants (of the nth kind) through all routes of exposure, dimensionless;

(4) Carcinogenic risks and non-carcinogenic hazard indexes of all pollutants

1) Using formula [32] to calculate the carcinogenic risks of all pollutants to be concerned about through all routes:

$$\mathrm{CR}_{\mathrm{sum}} = \sum_{1}^{n} \mathrm{CR}_{\mathrm{n}} \qquad [32]$$

Wherein: CR_{sum} – Total carcinogenic risks of all n kinds of pollutants to be concerned about, dimensionless;

2) Using formula [33] to calculate the non-carcinogenic hazard indexes of all pollutants to be concerned about through all routes of exposure:

$$\mathrm{H}Q_{\mathrm{sum}} = \sum_{1}^{n} \mathrm{H}Q_{\mathrm{n}} \qquad [33]$$

Wherein: $\mathrm{H}Q_{sum}$ – Non-carcinogenic hazard indexes of all n kinds of pollutants to be concerned about, dimensionless;

(5) Selection of exposure parameters

Complete soil cylindrical body cannot be acquired to measure physicochemical parameters because the topsoil of Ganshui site is backfill, including fragments and cuttings of mudstone and sandstone of different sizes with loose structure. Therefore, exposure parameters of Ganshui site may be selected by reference to recommended values in Technical Directive for Risk Evaluation of Contaminated Site (HJ25.3-2014). Please refer to Table 16 for details.

Table 16 Site Exposure Parameters

Parameter symbols	Parameter name	Unit	Recommended values for residential land
f_{om}	Content of soil organic matter;	$g\cdot kg^{-1}$	20
ρb	Soil volume weight	$kg\cdot dm^{-3}$	1.2
P_{ws}	Content of soil moisture	$kg\cdot kg^{-1}$	0.15
ρ_s	Soil grain density	$kg\cdot dm^{-3}$	2.65
PM10	Content of inhaled particles in the air	$mg\cdot m^{-3}$	0.15
Uair	Average annual wind speed of atmosphere of near-surface in soil contaminated area;	$cm\cdot s^{-1}$	200
δair	Atmospheric mixed layer height of near-surface of soil polluted area	cm	200
Wdw	Length of soil contaminated area parallel to the prevailing wind direction	cm	1500
θ_{acap}	Volume ratio of void air in soil of lamina capillaris	dimensionless	0.038
θ_{wcap}	Volume ratio of pore water in soil of lamina capillaris	dimensionless	0.342
θ_{acrack}	Volume ratio of air in foundation and wall fissure	dimensionless	0.26
θ_{wcarck}	Volume ratio of water in foundation or wall fissure	dimensionless	0.12
Lcrack	Thickness of indoor foundation	cm	15
LB	Ratio of indoor space volume to gaseous pollutant infiltration area	cm	200
ER	Rate of indoor air exchange	$times\bullet d^{-1}$	12
η	Proportion of surface area of foundation and wall fissure;	dimensionless	0.01
τ	Duration of gaseous pollutant invasion	a	24
EDa	Adult exposure cycle	a	24
EDc	Child exposure cycle	a	6
EFa	Adult exposure frequency	$d\cdot a^{-1}$	350
EFc	child exposure frequency	$d\cdot a^{-1}$	350
EFIa	Adult indoor exposure frequency	$d\cdot a^{-1}$	262.5
EFIc	Child indoor exposure frequency;	$d\cdot a^{-1}$	262.5
EFOa	Adult outdoor exposure frequency	$d\cdot a^{-1}$	87.5
EFOc	Child outdoor exposure frequency	$d\cdot a^{-1}$	87.5
BWa	Average adult weight	kg	56.8
BWc	Average child weight	kg	15.9
Ha	Average adult height	cm	156.3
Hc	Average children height	cm	99.4
DAIRa	Daily respiratory capacity of adult	$m^3\cdot d^{-1}$	15
DAIRc	Daily respiratory capacity of child	$m^3\cdot d^{-1}$	7.5
OSIRa	Daily amount of soil intake of adults	$m^3\cdot d^{-1}$	100
OSIRc	Daily amount of soil intake of child	$m^3\cdot d^{-1}$	200

Ev	Event frequency of daily skin contact	times•d-1	1
fspi	Proportion of particles in the indoor air coming from soil	dimensionless	0.8
fspo	Proportion of particles in the outdoor air coming from soil	dimensionless	0.5
SAF	Distribution proportion of reference dose exposed to soil	dimensionless	0.20
SERa	Ratio of adult exposed skin area in body surface area	dimensionless	0.32
SERc	Ratio of child exposed skin area in body surface area	dimensionless	0.36
SSARa	Soil sticking coefficient of adult skin surface	$mg\cdot cm^{-2}$	0.07
SSARc	Soil sticking coefficient of child skin surface	$mg\cdot cm^{-2}$	0.2
ABSo	Absorption efficiency factor of intake via mouth	dimensionless	1
PIAF	Proportion of inhaled soil particles left in the human body;	dimensionless	0.75
ATca	Average time of carcinogenic effect	d	26280
ATnc	Average time of non-carcinogenic effect	d	2190

4.5.2. Acceptable Risk Level

In the U.S. and some European countries, the maximum acceptable carcinogenic risk levels of contaminated site is within 10^{-4}~10^{-6}, and the acceptable hazard entropy is within 0.1~1.0. USEPA sets the acceptable carcinogenic risk level of single pollutants to be 10^{-6}. Both Missouri State EPA and New Mexico State EPA set the level to be 10^{-5}. In the Netherlands the Ministry of Housing, Spatial Planning and Environment has set the acceptable level to be 10^{-4} in formulating soil standards based on health risk evaluation.

The Technical Directive for Risk Evaluation of Contaminated Site (HJ-25.3-2014) issued by the MEP of China and the Evaluation Directive for Site Environment (DB11/T 656-2009) issued by Beijing Environmental Protection Administration state that the health risks that are caused by site contamination are thought to be unacceptable when single pollutant carcinogenic risks exceed 1×10^{-6} or their hazard entropy exceeds 1, which require management actions to be taken to eliminate risks or keep them within acceptable levels. However, such directive introduced a reference dose based on soil exposure and set the value to be 0.2 in the model of calculating target pollutants' hazard entropy.

Guidelines of Environmental Risk Evaluation Technology of Chongqing Sites issued by Chongqing Environmental Protection Administration states that the regional soil of the site shall be remedied when the accumulated carcinogenic risk levels of all pollutants are greater than 10^{-5} or the hazard entropy greater than 1. However, when it comes to calculating the remediation objectives of target pollutants, the guidelines states that the acceptable carcinogenic risk level for single pollutants is 1×10^{-6}, and the acceptable hazard entropy is 1.

By combining with the above-mentioned investigations and economic development level of Chongqing municipality, the acceptable carcinogenic risk level and hazard entropy of single pollutants are determined to be 1×10^{-6} and 1.0 respectively for the risk evaluation of Ganshui site. When risk of single target pollutants in the sampling point exceeds the said acceptable level, the management measures must be taken to reduce or control risks.

4.5.3. Calculation Results

Calculation results of health risks of target pollutants at Ganshui site, such as arsenic, a-BHC, β-BHC and γ-BHC, are shown in Table 17.

Table 17 Risk Calculation Results of Target Contaminants

Pollutant	Exposure pathway

	Oral administration	Skin exposure	Inhalation of particles	Inhalation of gaseous pollutant	Total
Carcinogenic risk					
As	1.89E-04	1.00E-06	1.70E-05	0.00E+00	**2.07E-04**
α-BHC	9.39E-06	1.10E-07	6.00E-08	4.00E-07	**1.05E-05**
β-BHC	8.71E-06	9.00E-08	1.70E-07	4.00E-07	**9.37E-06**
γ-BHC	4.46E-07	4.00E-09	4.00E-09	1.50E-08	4.69E-07
Hazard Quotient					
As	2.38E+00	2.00E-02	7.3E-01	/	**3.13E+00**
α-BHC	1.09E-03	1.00E-05	/	/	1.10E-03
β-BHC	/	/	/	/	/
γ-BHC	7.92E-03	8.00E-05	/	/	8.00E-03

Note: "/" indicates absence of toxicity parameters of the corresponding way

- Health risks of arsenic, α-BHC and β-BHC in the soil of Ganshui site have generally exceeded the acceptable risk levels specified by the country and Chongqing municipality: (1) carcinogenic risk of arsenic is 2.07×10^{-4}, exceeding the acceptable carcinogenic risk level 1.00×10^{-6} by 2 order of magnitudes. Hazard quotient of arsenic is also greater than acceptable level 1 and critical exposure routes are oral administration and inhalation of particles; (2) carcinogenic risk of α-BHC and β-BHC is 1.05× 10^{-5} and 9.37×10^{-6} respectively, exceeding the acceptable level by about 1 order of magnitude. Its critical exposure route is generally oral administration.
- The content of γ-BHC only in a soil sample (120 cm, sampling point 9#) is beyond the risk screening value. However, both their carcinogenic risks and hazard entropies are below the acceptable levels when taking into account the total γ-BHC pollution on the site. Therefore, γ-BHC will not be listed among contamination remediation objectives.

The above analysis shows that the relevant measures should be taken to remedy arsenic, α-BHC and β-BHC in the soil to protect the health of future receptors from being at unacceptable risk.

4.6. Remediation Targets Determination

As screening value of contaminated site soil is not specified in the national or Chongqing local standards, remediation targets of contaminated soil at Ganshui site will be determined by reference to Screening Value of Contaminated Site Soil (DB11/T 811 -2011) released by Beijing Municipality.

The first step for determining the remediation targets of Ganshui site: use dosage-effect model to perform inverse calculation of maximum allowable concentration of target pollutants in the soil under the condition of acceptable risk level (acceptable carcinogenic risk level and hazard entropy of single pollutants are determined to be 1×10^{-6} and 1.0 respectively) for getting the preliminary remediation targets of such pollutants.

The second step for determining remediation targets of Ganshui site: as the dose-effect model of remediation goal is too conservative, the initial arsenic remediation objective is 0.34 mg/kg that is far lower than the purple soil background values in Chongqing (3.52- 13.66 mg/kg), the initial α-BHC remediation objective is 0.06 mg/kg that is lower than the Netherlands α-BHC soil interference value of 17 mg/kg[3] and the American α-BHC soil interference value of 0.085

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[3] Circular on target values and intervention values for soil remediation, Government Gazette, Dutch, 2009.

mg/kg[4], andthe initial β-BHC remediation objective is 0.06 mg/kg that is lower than the Netherlands β-BHC soil interference value of 1.6 mg/kg and the American β-BHC soil interference value of 0.3 mg/kg. Therefore, considering the economic level of Chongqing Municipality, technological accessibility of remediation goal, Chongqing soil background values and so on, and the final remediation objectives of Ganshui site were determined by comparing with theoretical preliminary remediation target and Beijing screening values of contaminated sites, the results shown in Table 18 are satisfied with or close to an acceptable level of risk.

Table 18 Remediation Objectives of Target Contaminants (mg/kg)

Pollutant	Initial remediation objective	Screening value (Beijing)	Intervention value (Dutch)	Intervention values/risk value (USEPA)	Final remediation objective
As	0.34	20	76	--	20
α-BHC	0.06	0.2	17	0.085/ 4.1E-05	0.20
β-BHC	0.22	0.2	1.6	0.3/ 1.4E-04	0.22

4.7. Remediation Scope Determination

4.7.1. Supplementary Soil Sampling

After the preliminary investigations and detailed investigations, grid density of soil sampling at Ganshui site has reached 17 m×17 m, higher than the sampling density of 40 m×40 m specified in Technical Guidelines for the Investigations of Site Contamination (HJ25.1-2014) released by the Ministry of Environmental Protection. However, sampling layout at the first two stages is mainly concentrated at pesticide storage room and its surrounding area while sampling point is not set at the pesticide loading and unloading area at the southwest and northeast inside warehouse. It is necessary to conduct supplementary sampling for confirming whether soil of such area is contaminated or not. In addition, the remediation scope estimated based on preliminary investigations and detailed investigations may be large, which may easily result in excessive remediation. In order to further determine reasonable remediation scope, supplementary sampling of soil has been further conducted.

- Use expert judgment method to perform the supplementary layout at Ganshui site. Total 13 soil sampling points are arranged: among these, 2 sampling points are arranged inside pesticide warehouse and 11 sampling points are established at other areas outside pesticide warehouse. Supplementary sampling is conducted at twice: the first supplementary sampling is performed in March 2014 and supplementary sampling points are 10#, 11#, 12#, 13# and 14#; the second supplementary sampling is carried out in July 2014 and supplementary sampling points are17#, 18#,19#, 20#, 21#, 22#, 23# and 24#;
- No target contaminant is detected within the range of 0-1.0 m at the detailed investigation stage, so the sampling depth for this supplementary stage is initially determined as 1.5 m based on the principle of conservative consideration, and it can be adjusted according to the actual conditions. ☐
- Monitoring factors include lead, mercury, arsenic, BHCs and DDTs.
- Refer to site environment investigation methods of the second and third phases for samples collection, storage and circulation.

The supplementary sampling layout is detailed in Figure 12.

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[4] Regional Screening Level (RSL) Summary Table, US EPA, 2014.

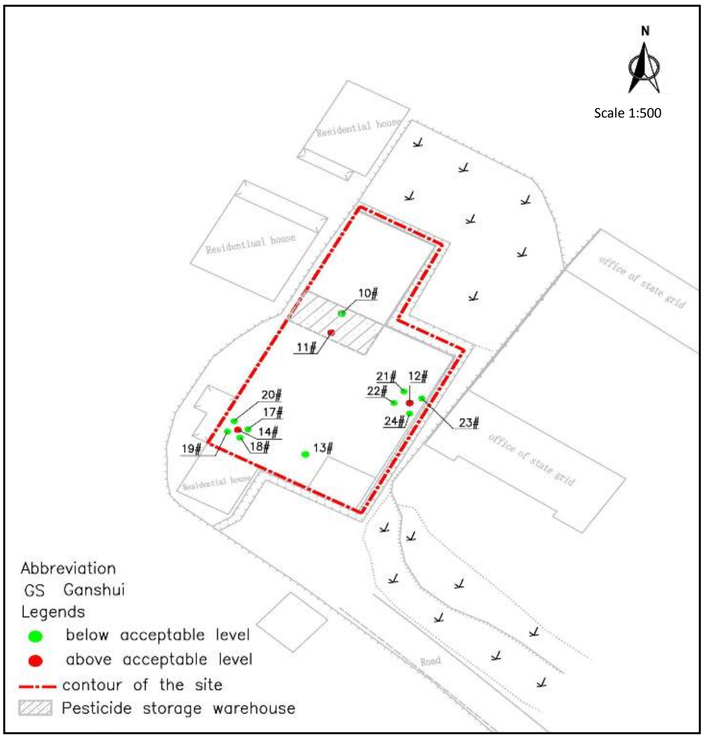


Figure 12 Supplementary Sampling Layout at Ganshui Site

4.7.2. Determination Results of Supplementary Sampling

According to the test report of SGS Shanghai Laboratory, the test results of soil samples of Supplementary Sampling Point of Ganshui site are shown in Table 19 and Annex 11 (Test report of Ganshui supplementary site investigations).

After soil test results of supplementary sampling are compared with residential land standards specified in Screening Value for Environment Risks of Site Soil released by Beijing city, contents of α-BHC at 11# point and 14# point soil have exceeded the specified contents; contents of β-BHC in the deep soil of 12# point have exceeded the specified contents; at other point location, contents of target contaminants were not exceeded the specified contents;

In 20 cm deep soil of 11# point, content of α-BHC is the highest with 0.39 mg/kg; in the 20 cm deep soil of 12# point, content of β-BHC is the highest with 0.28 mg/kg;

In the supplementary soil samples, apart from α-BHC, γ-BHC and β-BHC, other target contaminants are detected, but their content levels all did not exceed the residential land use standard of Beijing's Screening Levels.

Table 19 Determination Results of Supplementary Soil Samples (mg/kg)

Point depth Item	10#-2 (20cm)	10#-3 (60cm)	10#-4 (100cm)	10#-5 (160cm)	11#-2 (20cm)	11#-3 (60cm)	11#-4 (100cm)	11#-5 (150cm)	12#-1 (20cm)	12#-2 (60cm)	12#-3 (100cm)	13#-1 (20cm)	13#-2 (60cm)	13#-3 (100cm)
pH	7.4	7.4	7.5	7.2	5.6	7.4	7.4	7.7	5.8	4.1	5.1	4.7	4.8	4.8
Pb	19.3	17.2	19.3	24.1	21.2	18.0	20.9	19.2	59.4	13.7	12.9	14.4	18.7	17.6
As	3.5	2.7	4.9	9.7	2.8	3.0	2.1	2.7	2.8	1.4	0.7	1.7	1.5	1.9
Hg	0.16	0.14	0.11	0.10	0.16	0.22	0.12	0.10	0.14	0.05	0.06	0.10	0.12	0.03
α-BHC	nd	nd	nd	nd	**0.39**	nd	nd	nd	0.06	nd	nd	0.02	nd	nd
γ-BHC	nd	nd	nd	nd	0.11	nd	nd	nd	0.07	nd	nd	0.01	nd	nd
β-BHC	0.10	0.02	0.01	nd	0.05	nd	nd	nd	**0.28**	nd	nd	0.03	nd	nd
δ-BHC	nd	nd	nd	nd	0.03	nd	nd	nd	0.06	nd	nd	nd	nd	nd
BHCs*	0.1	0.02	0.01	nd	0.58	nd	nd	nd	0.47	nd	nd	0.06	nd	nd
DDE	nd	nd	nd	0.01	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDD	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDT	nd	nd	0.01	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDT*	0.02	nd	0.01	0.01	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

Table 19 Determination Results of Supplementary Soil Samples (continued) (mg/kg)

Point depth Item	14#-1 (20cm)	14#-2 (60cm)	14#-3 (100cm)	17#-1 (20cm)	17#-1 (50cm)	18#-1 (20cm)	18#-2 (50cm)	18#-3 (100cm)	19#-1 (20cm)	19#-2 (50cm)	20#-1 (20cm)	20#-2 (60cm)	20#-3 (100cm)
pH	4.7	4.0	3.9	4.2	3.7	4.5	4.5	5.5	4.2	4.2	4.8	4.1	3.8
Pb	22.0	15.2	22.9	22.7	15.1	23.7	17.5	21.3	18.3	23.3	21.9	23.3	27.1
As	2.6	1.2	2.4	8.6	2.6	1.6	1.4	1.9	1.4	1.3	2.8	2.5	1.8
Hg	0.19	0.13	0.14	0.50	0.22	0.13	0.14	0.07	0.12	0.04	0.16	0.08	0.17
α-BHC	**0.29**	0.05	nd	0.16	nd	0.02	nd	nd	0.06	0.02	0.13	0.04	nd
γ-BHC	0.19	0.02	nd	0.04	nd	nd	nd	nd	0.02	nd	0.05	0.02	nd
β-BHC	0.13	nd	nd	nd	0.01	0.01	0.01	0.01	0.06	0.03	0.05	nd	0.07
δ-BHC	0.08	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.04	0.03	nd
BHCs	0.69	0.07	nd	0.20	0.01	0.03	0.01	0.01	0.14	0.05	0.27	0.09	0.07
DDE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDD	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDT	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.01	nd	nd
DDT	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.01	nd	nd

Table 19 Determination Results of Supplementary Soil Samples(continued) (mg/kg)

Point depth Item	21#-1 (20cm)	21#-2 (60cm)	21#-3 (150cm)	22#-1 (20cm)	22#-2 (60cm)	22#-3 (100cm)	23#-1 (20cm)	23#-2 (50cm)	23#-3 (100cm)	24#-1 (20cm)
pH	4.4	4.2	4.0	4.1	3.6	3.5	4.5	3.9	3.9	4.3
Pb	35.7	27.5	13.0	30.8	15.7	20.0	17.4	25.7	18.4	26.5
As	1.5	3.7	1.1	1.4	4.0	1.8	1.7	1.5	4.0	1.9
Hg	0.11	0.23	0.07	0.11	0.10	0.03	0.15	0.22	0.06	0.17
α-BHC	0.02	nd	0.02	nd	nd	nd	nd	nd	nd	nd
γ-BHC	0.02	nd	nd	nd	nd	nd	nd	nd	nd	nd
β-BHC	0.02	nd	nd	nd	nd	nd	nd	nd	nd	0.02
δ-BHC	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
BHCs	0.06	nd	0.02	nd	nd	nd	nd	nd	nd	0.02
DDE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDD	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
DDT	0.03	0.03	0.03	nd	0.01	nd	0.08	nd	nd	0.07
DDT	0.03	0.03	0.03	nd	0.01	nd	0.08	nd	nd	0.07

Note: “nd” means that it is lower than detection limit and not detected. Detection limit of DDT, DDD, DDE, α-BHC, γ-BHC, β-BHC and δ-BHC is 0.01 mg/kg; Figure in red means that pollutants have exceeded the standards;

4.7.3. Spatial Distribution of Site Target Pollutants

24 soil sampling points, 11 structure sampling points and 2 underground water sampling points are set for Ganshui site investigations and its point location distribution is shown in Table 20 and Figure 13. Total 61 soil samples are collected and determined and test results of target pollutants arsenic, α-BHC and β-BHC are shown in Table 21:

Table 20 Summary of Environment Investigation Sampling

Site sampling	Quantity of sampling point	Location name
Soil sampling for preliminary investigations	2	Ganshui 1# and Ganshui 2#
Soil Sampling of detailed investigations	9	Ganshui D1#, Ganshui D2#, Ganshui D3#, Ganshui D4#, Ganshui D5#, Ganshui D6#, Ganshui D9#, Ganshui D15#, background point soil DZ
Soil sampling of supplementary investigations	13	Point location for the first supplementary sampling: 10#,11#, 12#, 13#,14#; point location for the second supplementary sampling: 17#,18#、19#、20#、21#、22#、23#、24#
Warehouse wall and ground surface sampling	11	Wall: 1#,2#,3#, 4#, 5#, 6#,7#,8#; earth surface: 9#, 10#, 11#
Sampling of groundwater	2	Ground water 1# and Ground water 2#
Total	37	

- There are 7 sampling points exceeding standards, namely Ganshui 1#, Ganshui D1#, Ganshui D2#, Ganshui D9#, Ganshui D11#, Ganshui D12# and Ganshui D14#. The percentage of exceeding standard is 29.2% of total sampling points. Among these, there are 2 sampling points in which arsenic has exceeded the specified contents, namely Ganshui 1# and Ganshui D1#, with exceeding standard percentage of 8.3%; there are 5 sampling points in which α-BHC has exceeded the specified contents, namely Ganshui D1#, Ganshui D2#, 9#, 11# and 14# with exceeding standard percentage of 20.8%; there are 5 sampling points in which β-BHC has exceeded the specified contents, namely Ganshui 1#, Ganshui D1#, Ganshui D2#, 9# and 11# with exceeding standard percentage of 20.8%; there is one sampling point in which γ-BHC has exceeded the specified contents, namely 9#, with exceeding standard percentage of 4.2%;
- There are 8 soil samples exceeding the standards with exceeding standard percentage of 13%. Among these, there are 2 soil samples with arsenic exceeding the standards, namely 3% exceeding standard percentage; there are 6 soil samples with α-BHC and β-BHC exceeding the standards and exceeding standard rate is 10%; there is one soil sample with γ-BHC exceeding the standards and exceeding standard rate is about 1.5%;
- Main target pollutants in the sample collected from the surface layer of building (including wall and earth surface) inside pesticide warehouse are β-BHC and its contents vary between nd and 2.33 mg/kg. Exceeding standard rate on the surface layer of building at all sampling points is 36.4%;
- Target pollutants are not detected in the underground water and background point soil.

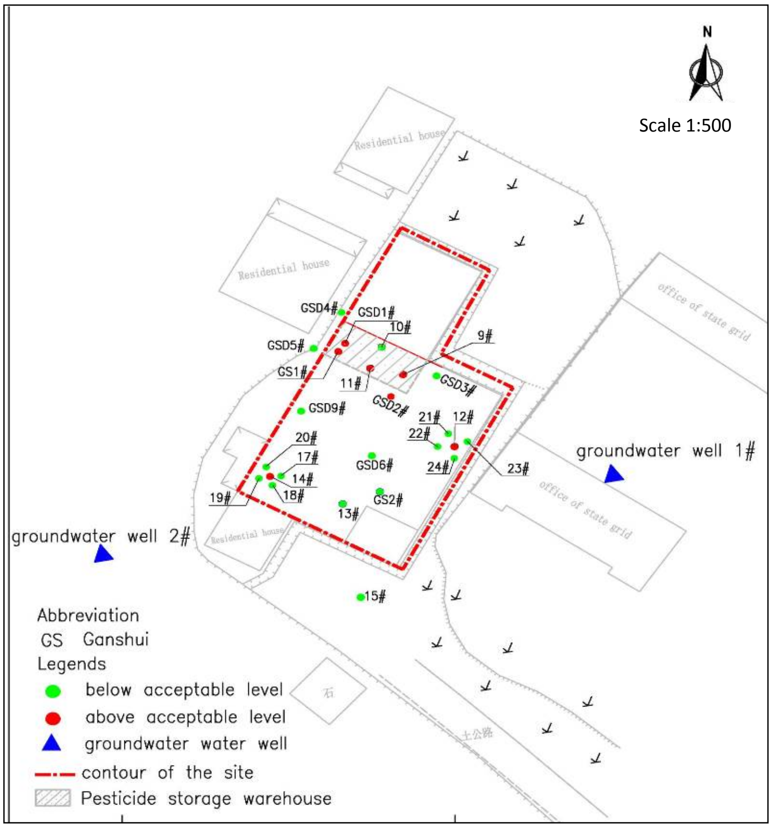


Figure 13 Summary of All Sampling Points at Ganshui Site

As the maximum sampling depth of Ganshui site is 1.6 m, 0-0.8 m soil and 0.8-1.6 m soil are determined as the first layer and the second layer respectively when Surfer(10.0 version) is used to study feature of spatial distribution of arsenic, α-BHC and β-BHC at Ganshui site, which is shown in Figure 14.

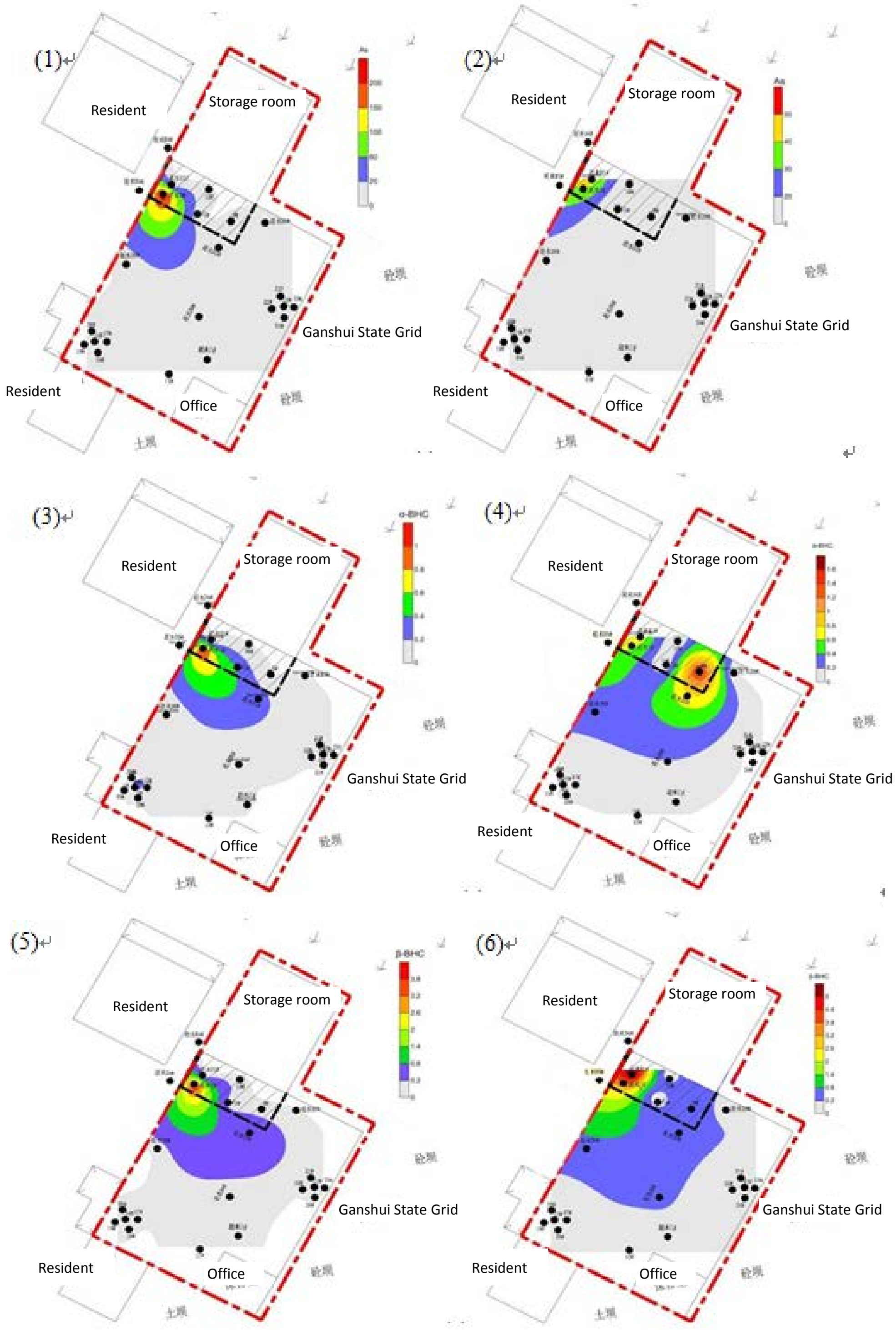


Figure 14 Spatial Distribution of Target Pollutants at Ganshui Site (1) Arsenic distribution at 0-0.8 m; (2) Arsenic distribution at 0.8-1.6 m; (3) α-BHC distribution at 0-0.8 m; (4) α-BHC distribution at 0.8-1.6 m; (5) β-BHC distribution at 0-0.8 m; (6) β-BHC distribution at 0.8-1.6m; grey means that content of target pollutants in the soil is lower than soil remediation target and remediation is not required; blue, green, yellow and red mean that content of target pollutants in the soil is higher than soil remediation target and remediation is needed.

Spatial distribution of arsenic, α-BHC and β-BHC pollutants in the soil of Ganshui site has the following features:

(1) Arsenic, α-BHC and β-BHC pollutants that exceeding the standards are mainly concentrated inside warehouse and the most serious polluted area is pesticide storage room. This is related to use function of pesticide storage;

(2) The distribution of pollutant concentration at Ganshui site possesses strong space difference. Arsenic pollution is concentrated at 0-0.8 m layer soil while α-BHC and β-BHC pollutants are mainly concentrated at 0.8-1.6 m layer soil, which suggests that pollutants have migrated vertically. These distribution features are closely linked to high percentage of clay at Ganshui site. Arsenic and BHC pollutants are weakly migrated in such soil, provided that, it does not rule out the fact that pollutants have spread along loose accumulation zone or specific direction, thereby intensifying the spatial specificity of pollutants concentration distribution.

Table 21 Summary Data of Target Pollutants of All the Sampling Points

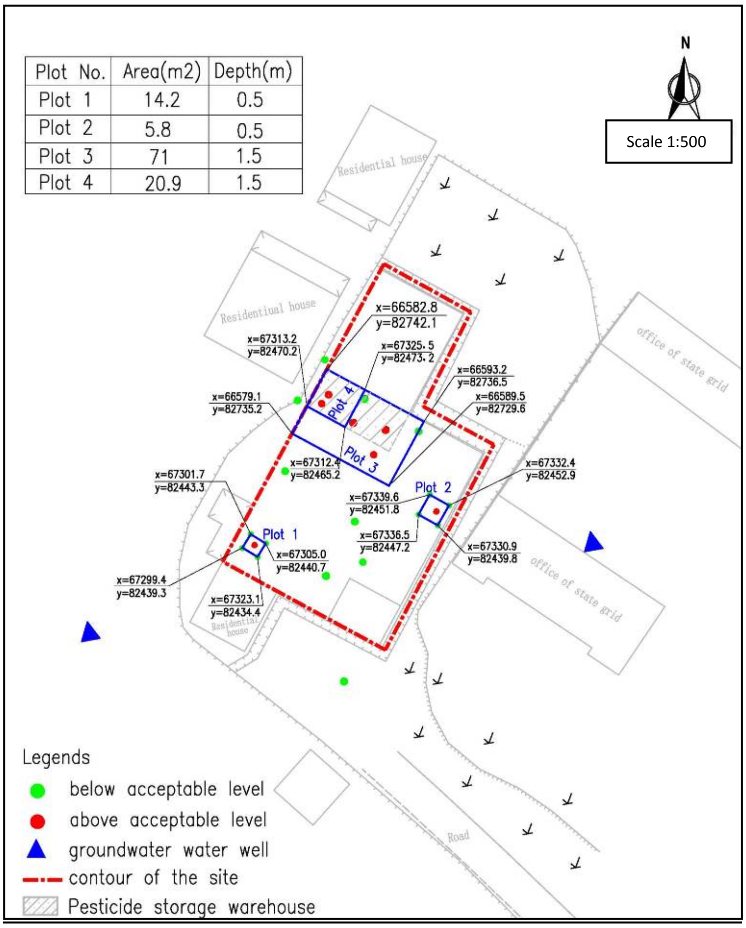
Sample No.	Depth	Monitoring item			Sample No.	Depth	Monitoring item		
		As	α-BHC	β-BHC			As	α-BHC	β-BHC
Ganshui 1#	0.2	**238**	1.1	**4.04**	9#-5	1.6	0.8	0.03	0.03
Ganshui 2#	0.2	3.6	nd	0.04	10#-2	0.2	3.5	nd	0.1
Ganshui D1#-2	0.5	5.8	nd	0.02	10#-3	0.6	2.7	nd	0.02
Ganshui D1#-3	1.0	3.2	0.02	0.08	10#-4	1.0	4.9	nd	0.01
Ganshui D1#-4	1.5	**46**	**0.79**	**5.35**	10#-5	1.6	9.7	nd	nd
Ganshui D2#-1	0.2	1.0	**0.31**	**0.62**	11#-2	0.2	2.8	**0.39**	0.05
Ganshui D2#-2	0.5	1.4	**0.21**	**0.27**	11#-3	0.6	3.0	nd	nd
Ganshui D3#-1	0.2	4.9	0.01	0.02	11#-4	1.0	2.1	nd	nd
Ganshui D3#-2	0.5	3.0	0.01	0.01	11#-5	1.5	2.7	nd	nd
Ganshui D3#-3	0.9	1.6	nd	nd	12#-1	0.2	2.8	0.06	**0.28**
Ganshui D4#-1	0.2	2.2	nd	nd	12#-2	0.6	1.4	nd	nd
Ganshui D5#-1	0.2	7.9	nd	nd	12#-3	1.0	0.7	nd	nd
Ganshui D5#-2	0.4	3.6	nd	nd	13#-1	0.2	1.7	0.02	0.03
Ganshui D6#-1	0.2	1.4	nd	0.02	13#-2	0.6	1.5	nd	nd
Ganshui D6#-2	0.5	0.9	nd	nd	13#-3	1.0	1.9	nd	nd
Ganshui D9#-1	0.2	2.1	0.03	0.04	14#-1	0.2	2.6	**0.29**	0.13
Ganshui D9#-2	0.5	2.5	0.01	0.03	14#-2	0.6	1.2	0.05	nd
9#-2	0.2	2.5	nd	0.08	14#-3	1.0	2.4	nd	nd
9#-3	0.6	1.2	nd	nd	15#-1	0.2	5.9	nd	nd
9#-4	1.2	1.2	**1.53**	**0.51**	15#-2	0.6	4.5	nd	nd
17#-1	0.2	8.6	0.16	nd	21#-1	0.2	1.5	0.02	0.07

17#-2	0.5	2.6	nd	0.01	21#-2	0.5	3.7	nd	0.02
18#-1	0.2	1.6	0.02	0.01	21#-3	1.0	1.1	0.02	nd
18#-2	0.5	1.4	nd	0.01	22#-1	0.2	1.4	nd	nd
18#-3	1.0	1.9	nd	nd	22#-2	0.5	4.0	nd	nd
19#-1	0.2	1.4	0.06	0.06	22#-3	1.0	1.8	nd	nd
19#-2	0.5	1.3	0.02	0.03	23#-1	0.2	1.7	nd	nd
20#-1	0.2	2.8	0.13	0.05	23#-2	0.5	1.5	nd	nd
20#-2	0.5	2.5	0.04	0.05	23#-3	1.0	4.0	nd	nd
20#-3	1.0	1.8	nd	nd	24#-1	0.2	1.9	nd	0.02
DZ	0.2	2.0	nd	nd					

Note: “nd” means that it is lower than detection limit and not detected. Detection limit of α-BHC and β-BHC is 0.01 mg/kg;
Figure in red means that pollutants have exceeded the standards;

4.7.4. Determination of Site Remediation Boundary

Surfer interpolation method is used to analyze the spatial distribution of arsenic, α-BHC and β-BHC pollutants at Ganshui site. It is found that its pollution scope has expanded (Figure 14), which deviates slightly from actual circumstances of site. Therefore, the remediation boundary centered the excessive points and joint all the nearest around un-excessive points (Figure 15):



Plot No.	Area(m2)	Depth(m)
Plot 1	14.2	0.5
Plot 2	5.8	0.5
Plot 3	71	1.5
Plot 4	20.9	1.5

Figure 15 Remediation Scope of Ganshui Site

- Only 0.2 m deep soil at 14# point of remediation plot 1 and 12# point of remediation plot 2 exceeded the standards. However, contents of target pollutants at 0.4 m deep soil of these two plots do not exceed the standards. From the conservative perspective, excavation depth of remediation plot 1 and remediation plot 2 is determined to be 0.5 m.
- Points exceeded the standards in remediation plot 4 include Ganshui 1# and Ganshui D1#; points exceeded the standards in remediation plot 3 include Ganshui D2#, 9# and 11#. And Ganshui D1# point has the largest depth (about 1.5 m). As below 1.5 m of this plot is bedrock, it is impossible to collect the sample from deeper layer soil. Given that remediation region is within the pesticide storage room, excavation depth should be set at 1.5 m conservatively.
- α-BHC and β-BHC contents have exceeded the soil remediation interference value in the wall (4 walls) of surface layer and ground (1) inside pesticide warehouse, but its leaching concentration does not reach the standard limiting value of BHCs 0.5 mg/L specified in Identification Standards of Hazardous Wastes-Identification of Leaching Toxicity (GB 5058.3-2007). Therefore, wall on the surface layer is treated as contaminated soil. Wall of pesticide storage warehouse is 12 cm thick cob

wall and its pollution way is mainly the adhesion of dust containing pesticide. Therefore, it is necessary to clear, collect and dispose of 0-5 cm soil on the surface layer of contaminated wall.

4.7.5. Prediction of Remediation Volume

After the above analysis the remediation volume of Ganshui site is predicted as shown in Table 22.

Table 22 Predicted Volume of Site Remediation

Plot	Area (m^2)	Depth (m)	Capacity (m^3)	Target pollutants	Pollution degree
Remediation plot 1	4.2	0.5	2.1	α-BHC and β-BHC	Low-polluted
Remediation plot 2	5.8	0.5	2.9	α-BHC and β-BHC	Low-polluted
Remediation plot 3	71.0	1.5	106.6	α-BHC and β-BHC	Low-polluted
Remediation plot 4	20.9	1.5	31.4	Arsenic and α-BHC β-BHC	• Moderately polluted by arsenic • Low-polluted by α-BHC and β-BHC
Wall surface of the building	153.7	Wall: 0.05 Ground: 0.10	7.7	α-BHC and β-BHC	Low-polluted
Total	/	/	150.7	/	/

Note:

(1) The total excavation capacity of Ganshui site is about 142.3 m^3 in accordance with the evaluation requirements for environmental risk quantification;

(2) The contaminated soils for remediation refer to that with a carcinogenic risk higher than 10-6.

(3) The concentration of target pollutants in the dredging volume is higher or equal to the relevant remediation guidance value, without considering the added surplus quantity for the sake of assurance in excavation.

(4) Dredging volume of the contaminated soils uses the ground or manhole zero point as starting computation surface. When field elevation is measured, the earth surface not covered by construction waste is used as the starting point.

(5) For the surface layer of structure involved, it is necessary to clean up 4 walls (width × height × length = 4.5 m×3.8 m×9.5 m) and 1 ground. Therefore, its total area is about 150.7 m^2 and the total volume of wall surface to be cleaned is about 7.7 m^3.

(6) Contents of arsenic in the soil are between 20 mg/kg and 300 mg/kg, reaching the degree of moderation pollution; contents of α-BHC and β-BHC in the soil are between 0 and 6 mg/kg, reaching the degree of low pollution.

5. Technical Scheme for Ganshui Site Remediation Project

5.1. Physical and Chemical Properties of Pollutants

The target pollutants in the contaminated soil of Ganshui site include As, α-BHC and β-BHC. The physical and chemical properties of these pollutants are shown in Table 23.

Table 23 Physical Properties of Target Contaminants

Physicochemical parameters	As	α-BHC	β-BHC
Molecular weight (g/mol)	74.9	290.8	290.8
Water-organic carbon partition coefficient	/	2180	2180
Octanol-water partition coefficient (Lg Kow)	/	4.26	4.26
Air diffusion coefficient (cm^2/s)	/	0.04	0.03
Water diffusion and partition coefficient (cm^2/s)	/	5.05×10^{-6}	7.40×10^{-6}
Solubility (mg/L, 20 ^oC)	/	2	0.54
Henry's constant (dimensionless)	/	2.0×10^{-4}	2.0×10^{-4}

Steam pressure (mmHg)	/	4.26×10^{-5}	4.90×10^{-7}
Half-life period (d)	/	270	248
Melting point (^{o}C)	817	158	312
Boiling point (^{o}C)	613	288	/
Density g/ml	5.71	1.89	1.89
Cancer slope factor (SF) [mg/(kg·d)]$^{-1}$	1.5	6.3	1.8

Table 20 indicated that the target pollutants are all carcinogenic with highly toxicity. In addition, α-BHC and β-BHC may be easily absorbed by the soil organic matters because of high water-organic carbon partition coefficient; may not easy to degrade due to long half-life period; and are nonvolatile due to high saturated steam pressure. According to the physical and chemical properties of the target pollutants, it is determined to adopt source removal method for Ganshui Site remediation.

5.2. Soil Physical-Chemical Properties

The result of hydrogeologic survey indicated that the contaminated soil in Ganshui site is mainly distributed in the backfilled soil layer with the depth less than 1.5 m. Lithologically, the contaminated soil mainly consists of silty soil. The water content of the soil is less than 15%, soil bulk density is 1.10-1.35 g/cm^3, soil density is 2.20-2.70 g/cm^3, total porosity is 50.59%- 57.48%, organic content is 1.40%-3.50%, calcium carbonate content is 1.78% -3.69%, total nitrogen content is 0.083% -0.187%, total phosphorous content is 0.028%-0.052% and total potassium content is 0.028% -0.052%.

5.3. Overall Implementation Plan of Site Remediation

In consideration of small volume of contaminated soil at Ganshui site and in order to shorten the remediation and supervision period, it is suggested to completely remove the pollutants from the site first, and then conduct ex-situ remediation for the contaminated soil so as to achieve the remediation goals. The overall technical route for Ganshui Site remediation is shown in Figure 17, covering the protection of existing buildings, clearing, excavation, transportation and storage of contaminated soil, the implementation of the contaminated soil remediation scheme and the validation of the contaminated soil after remediation.

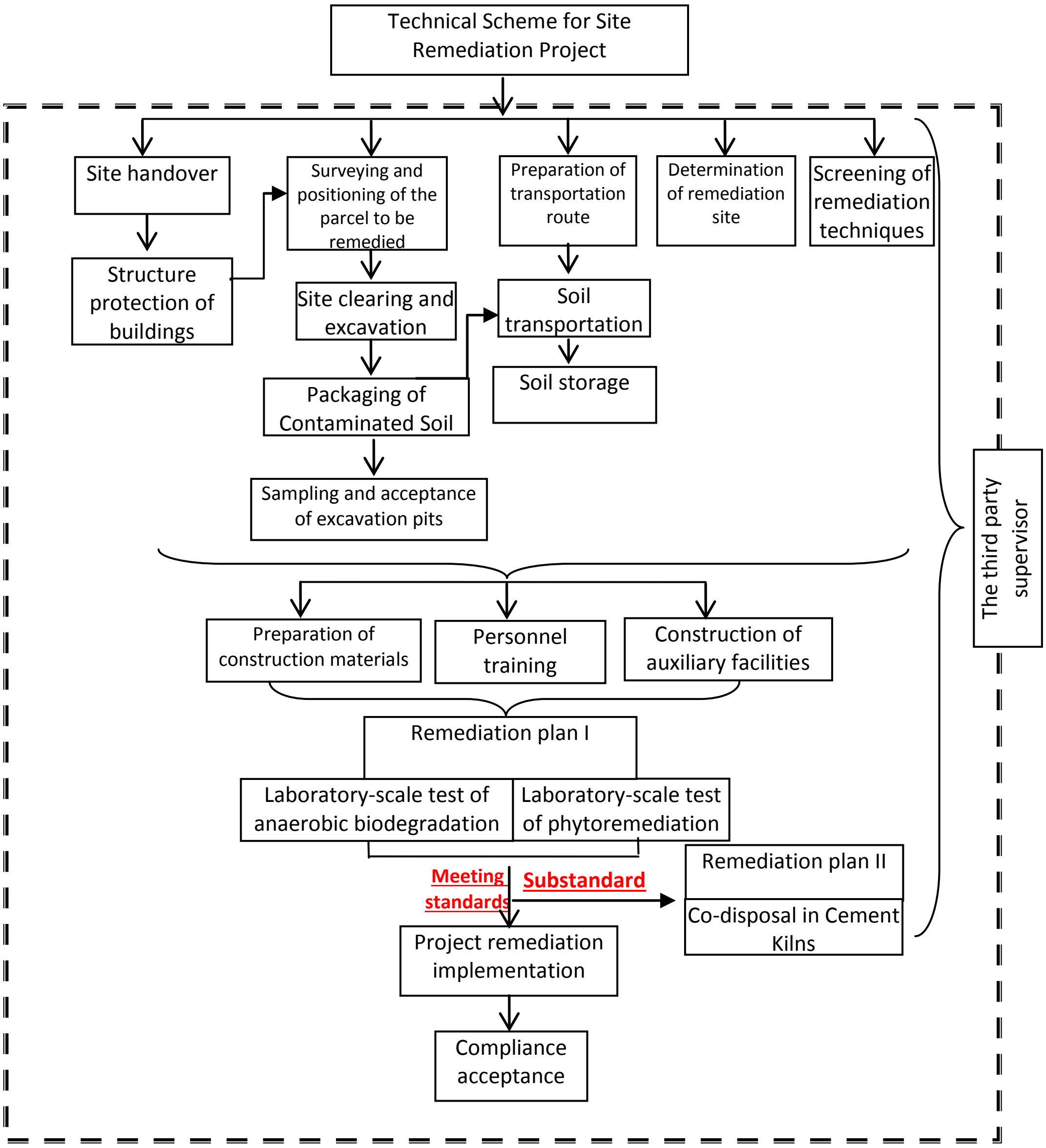


Figure 17 Overall Technical Route for Ganshui Site Remediation

Note:

(1) After excavation, the contaminated soil at Ganshui site is transported to Chongqing Lafarge Cement Plant for storage, anaerobic biodegradation and demonstration of phytoremediation.

(2) This scheme does not include the construction and materials of auxiliary facilities, which will be specified in the *Construction Scheme for Remediation of the Contaminated Site* put forward by the Bidder.

(3) In this scheme, the main content and requirements of third-party supervision and remediation validation are shown in the part of environmental management plan and the *Supervision Scheme* and *Validation Scheme* will be prepared by the third-party supervisor and the validation unit after the *Construction Scheme for Remediation of the Contaminated Site* is determined.

5.3.1 Excavation Plan for the Contaminated Soil

Excavation of Ganshui site should be implemented as the routine shown in Figure 18.

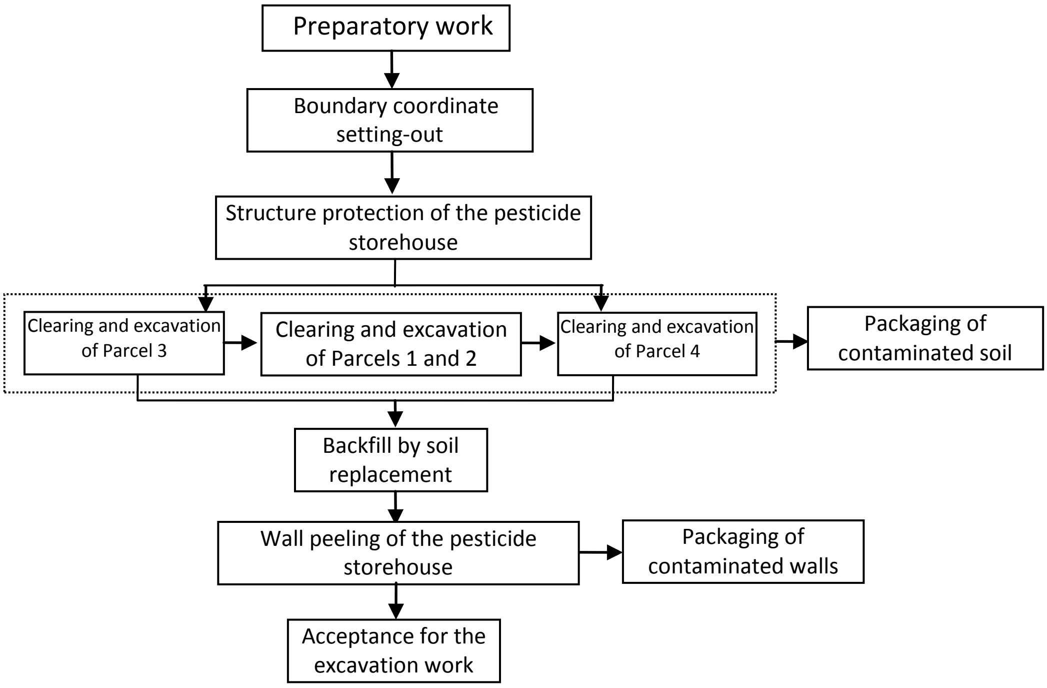


Figure 18 Site Excavation Working Routine

5.3.2. Site Handover

In order to successfully implement the remediation project of Ganshui site after quantitative assessment, the Owner Agent (Chongqing Project Management Office, Chongqing PMU) should hand over the management right and relevant documents of Ganshui site to the Bid Winner (namely, Contractor) immediately upon determining the contractor.

In addition, Chongqing PMU should conduct stake delivery-receiving for the remediation area, together with the Contractor and the Supervisor: implement handover point by point, check the actual conditions and make clear marks at the site. After stake delivery-receiving, the Contractor should resurvey the stakes so as to achieve correct control stake and elevation.

5.3.3. Preparation before Excavation

The remediation Contractor of Ganshui site must have the qualifications of excavation, transportation and construction.

The Owner (or Owner Agent) may assist the remediation Contractor in going through the formalities for filing and registration at the administrative department of traffic and the competent department of environmental protection, so as to acquire the transportation route permit and transportation regulation.

The remediation Contractor should thoroughly investigate Ganshui site and surrounding area and then develop an appropriate remediation scheme, structure protection scheme and emergency plan based upon the potential pollution risks during construction.

Before the commencement of site excavation, all construction tools (shovels, double-layer bags, protective plastic film and adhesive tape, etc.) and labor protection articles etc. should be in place; the fence-enclosing work should be completed; and warning marks should be set.

5.3.4. Survey of Excavation Area

In order to successfully implement the excavation work of Ganshui site, it is required to conduct surveying and positioning in accordance with the following specifications and requirements:

(1) Obey the *Code for Engineering Surveying* (GB 50026-2007);

(2) Comply with the local engineering construction standards of Chongqing ;

(3) Set the elevation surveying control point for repeated survey of elevation.

Site excavation: measure the inflexion point coordinates of each area with a total station device and level gauge device based upon the designated control coordinates and elevations according to the principle of “global-to-local”; and record the measurement results for calculation of remediation volume and engineering settlement in the future.

Validation for the excavation work: re-check the excavation depth, excavation boundary and actual excavation volume according to the quantitative assessment for environmental risks of Ganshui site (or according to the final adjustment requirements if the excavation boundary is adjusted) and submit the recheck results to the competent department for filing. The details of the working procedure are stated as follows:

- Survey and set fixed set-point control for the inflexion point coordinates and elevations of the contaminated plots within the Site with a total station and level gauge as per the inflexion point coordinates of each plot given in the quantitative assessment for environmental risks of Ganshui Site (Table 24 and Fig. 16) and in line with the requirements of the *Code for Engineering Surveying* (GB50026-2007).
- Add additional stakes to build a surveying control network, according to control stakes, baseline stakes, traverse line stakes and benchmark stakes and the actual conditions at the Site and in line with the requirements of the *Code for Engineering Surveying*.
- Conduct coordinates setting-out for the contaminated plots with a total station according to the coordinates and elevations of the control points: set the angular points with small stakes; set the boundaries of each contaminated plot with wide lines; set the boundaries and build a square grid with lime powder; control the elevation with a level gauge;
- Identify the excavation plots with signboards and indicate the shape, excavation depth and inflexion point coordinates of each plot, set the surveying control stakes and inflexion points with lime lines and then educe control stakes.

Table 24 Inflexion Point Coordinates of the Remediation Plots

Remediation plot	Contaminant	Inflexion point coordinates (1)	Inflexion point coordinates (2)	Inflexion point coordinates (3)	Inflexion point coordinates (4)	Inflexion point coordinates (5)	Inflexion point coordinates (6)
Remediation plot 1	α-BHC β-BHC	X=67301.7 Y=82443.3	X=67299.4 Y=82439.3	X=67323.1 Y=82434.4	X=67305.0 Y=82440.7		
Remediation plot 2		X=67339.6 Y=82451.8	X=67336.5 Y=82447.2	X=67330.9 Y=82439.8	X=67332.4 Y=82452.9		
Remediation plot 3		X=67313.2 Y=82470.2	X=66579.1 Y=82735.2	X=66589.5 Y=82729.6	X=66593.2 Y=82736.5	X=67325.5 Y=82473.2	X=67312.4 Y=82465.2
Remediation plot 4	As α-BHC β-BHC	X=66582.8 Y=82742.1	X=67313.2 Y=82470.2	X=67312.4 Y=82465.2	X=67325.5 Y=82473.2		

5.3.5. Structure Protection and Wall Peeling of Contaminated Buildings

5.3.5.1. Structure Protection Scheme

Due to the damage of Ganshui warehouse, the foundation may get instable during excavation, which may result in deformation of the upper part and falling-off of rubble and roof. In order to ensure the safety in excavation of the contaminated soil, Chongqing PMU entrusted

Southwest Geotechnical & Design Institute of China Nuclear Industry to develop an excavation protection plan (Annex 12 Scaffold Construction Design). In the plan, it is determined to adopt the method of reinforcement by indoor wall foundation pit piles and "scaffold+ bamboo board". Meanwhile, it is planned to implement scaffold construction as follows:

(1) Reinforcement of house foundation: the house foundations of Ganshui site are mainly built up with dressed stones. The buried depth is about 0.3 m-0.5 m and the root parts have been deformed. In order to avoid disturbance caused by site excavation, a safety clearance which is about 1.5 m wide is left on the edge of the foundation.

(2) Before set-up, it is required to strictly check the scaffold poles entering the Site. The scaffold poles which are non-conforming in specifications and quality are not allowed.

(3) Set up the scaffold on the firm foundation snapline in the following sequence: position the upright tube → put the bottom horizontal tube in the right place → erect the upright tube and tightly connect it with the bottom horizontal tube → mount the first putlog → mount the second ledger → mount the second putlog → set a temporary diagonal brace, with the upper part closely coupled with the second ledger (removed after the connecting rod is mounted) → mount the third and fourth ledgers and putlogs → mount the pull rod on the second layer → connect the pull rod → set up a bridging→ lay the scaffold boards and bind the protection plate and toeboard.

(3) After the floor-type double pole steel tubular scaffold with couplers erected indoors passes the inspection, mount the bamboo board onto the scaffold. In general, scaffold boards are made of bamboo and each board is not higher than 30 kg in weight, not lower than 3 m in width and not higher than 6 m in length.

(4) Set the safety vertical net with the mesh not higher than 10 cm. The net should be made of vinylon, chinlon, nylon or any similar material. Destructive or corrosive safety net and polypropylene fiber net are forbidden.

The material requirements, provisions and safety design for scaffold erection are shown in Annex 12 (Scaffold Construction Design).

5.3.5.2. Surface Peeling Scheme for Contaminated Walls

The wall surface of the pesticide storehouse at Ganshui Site is contaminated:

- Confirm that all electric wires and water tubes inside the walls are cut off before wall peeling;
- Lay double waterproof plastic films on the ground so as to collect the materials peeled from the contaminated wall surface;
- Wet the surface of the walls with water for two or three times at an interval of 20-30 min;
- Manually scrap off the contaminated walls with flat spade, hammer, scraper blade, trowel and other necessary tools section by section from top to bottom. Generally, the thickness of the peeled wall is about 0-5 cm. It is prohibited to damage such structures as brick wall, beam and slab;
- Collect the peeled materials while peeling and pack the materials into double-layer bags so as to transport them to Lafarge Cement Plant for disposal in the same manner as contaminated soil;
- Wear personal safety protection articles, such as helmet, mask and gloves in peeling and collection;

5.3.6. Site Excavation

5.3.6.1. Excavation of Contaminated Soil

According to the Owner's (Ganshui Supply and Marketing Cooperative) requirement for preserving the original buildings and in consideration of small excavation volume (the maximum excavation depth is 1.5 m), it is determined to manually perform the excavation by the means of quit excavation and compaction section by section. The excavation work should be completed as per the excavation scheme and the following requirements:

(1) Cut off all water, power and gas supply lines within Ganshui site and remove the wastes and sundries on the plots to be excavated before excavation.

(2) Excavate the contaminated soil plot by plot, in order to facilitate packaging and outward transportation of contaminated soil: excavate Plot 4 first with shovel, pickmattock and other necessary tools. This plot is contaminated by As, α-BHC and β-BHC; thus, the contaminated soil should be directly sealed with red bags. Before and after excavation, the excavation equipment and tools should be cleaned.

(3) Excavate Plots 1 and 2 close to the entrance/exit of the warehouse after the excavation of Plot 4 is completed. In these two plots, soil are mainly contaminated by α-BHC and β-BHC; thus, the soil should be sealed with white bags.

(4) In the excavation of Plot 3, the area where Plots 1 and 2 are located is used as the working area for soil packaging and the passage. Therefore, it is required to cover the ground with double-layer waterproof adhesive tape (or impermeable film with thickness of 50 mm) and cover the walls with plastic films so as to prevent the contaminated soil from diffusing through dust.

(5) Excavate the remediation plots with a known sampling point as the starting point, until the specified excavation depth and boundary are reached. The single-step footage of excavation is recommended to be 0.5 m in both horizontal and vertical directions. If hard bedrock is found horizontally and vertically, excavation should be stopped.

Keep a close watch on the soil characteristics during excavation, including the color, odor, soil properties, water content, underground utilities or structures. If any exceptional condition is discovered, it is required to stop excavation immediately and notify the Supervisor, Owner and field technicians. Excavation can be continued only after the exceptional condition is eliminated.

(6) Conduct an intermediate inspection: at the stage when it cannot be confirmed whether the contaminated soil has been completely removed after excavation, it is required to collect soil samples from the bottom and walls of the pit by a prescribed method and analyze and detect the samples:

- If the concentration of the pollutants meets the standard, it is required to stop excavation;
- If the pollutant concentration cannot meet the standard, it is required to continue the excavation and conduct an intermediate inspection from time to time until the pollutant concentration at the bottom and on the walls of the pit complies with the requirements.
- If the pollutant concentration still cannot meet the standard when the designed excavation range and depth are reached, it is required to conduct tentative expansion.

(7) Stagnant water in the pit during excavation: if any stagnant water is discovered in the pit during excavation, it is required to collect the water with a submersible pump and discharge the same when it meets relevant standard upon uniform treatment. According to the existing data, Ganshui site is 5 m higher than the surrounding areas in the west, north and south; the buried depth of the bedrock is about 2 m; and the stable underground bedrock fissure water is about 10.5 m away from the ground. Therefore, it is almost impossible to discover underground water when excavating the contaminated soil with the depth less than 2 m.

(8) Set sufficient lighting facilities, hazardous location marks and fences for the construction at night;

(9) Inspect the conditions of the pit walls at any time during excavation and provide necessary support and protection from being injured by collapse;

(10) Designate relevant persons on duty and provide necessary labor protection articles (helmet, mask, gloves and protective clothing) so as to guarantee the safety and health of workers in construction;

(11) Prevent and control "secondary pollution" in construction and soil remediation strictly in accordance with the construction scheme and technical requirements.

5.3.6.2. Backfill by Soil Replacement

After the contaminated soil at Ganshui Site is excavated and the excavation pits pass the inspection, the pits should be backfilled with soil replacement method as follows:

- Select non-contaminated foreign soil near Ganshui site, the quality of soil, conditioning and requirements are as follows:

Pollutant containing: backfill soil after detection should not contain heavy metal pollutants, typical volatile organic contaminants, pesticide pollution, petroleum hydrocarbons pollutants, etc.;

Soil characteristics: the types of clay, silty clay, silt as backfill soil are preferentially used for backfill with the soil particle size not more than 50 mm and maximum dry density of 1.58 g/cm^3 ~ 1.95 g/cm^3. Generally, the mud and silt soil, expansive soil, the soils of more than 8% organic matters, and higher than 5% soluble sulfate can't be used for backfill;

The maximum soil moisture: the maximum soil moisture for backfill soil is in the range of 16% ~ 23% (*m* %);

- Move the mellow soil on the surface (with the thickness of 25 cm) aside, excavate the immature soil with a backdigger, load the soil with a loading machine and then transport it to Ganshui site with dump truck;
- Manually unload the soil from the dump truck and transport it to the excavation pits;
- Manually screen the soil to remove the stones, wastes and tree roots with the grain size larger than 50 mm;
- Fill the excavation pits with the screened soil by layers from the bottom and mechanically compact the soil after filling for every 30 cm, the compact degree is not greater than 0.9. In filling, it is required to frequently check the water content and compactness and arrange dewatering and/or watering according to the results. The field compactness test should be subject to the provisions of GB/T50123 and the copy of the test results should be submitted to the Project Supervisor.

5.3.7. Packaging of Contaminated Soil and Wastes

(1) After excavated, the contaminated soil should be packaged with double-layer bags on-site. Generally speaking, the contaminated soil containing As should be packaged with red bags and that containing BHCs only should be packaged with white bags (the contaminated soil containing BHCs at Ganshui site is of low pollution). The filling rate of each bag should be 80%-90%. For the contaminated soil with the water content lower than 10% which may generate dust in packaging, it is required to take watering measure so as to prevent the hazardous substances in the dust from damaging the environment and human body.

(2) The contaminated soil should be packaged in the warehouse at Ganshui site and the working surface for packaging should be paved with double-layer waterproof adhesive tape (or impermeable film that is 50 mm thick).

(3) All field workers should wear protective clothing, shoes, masks and gloves.

(4) During excavation, the workers should change the clothes before leaving the working site. When the excavation work is completed, the excavation tools (such as shovel and pick mattock) should be cleaned with a wet cloth and the working clothes, color cloth, gloves and

the wet cloth used for cleaning the tools, etc. should all be packaged with double-layer waterproof bags and managed and disposed in the same manner as contaminated wastes.

5.4. Plan for Transportation of Contaminated Soil

5.4.1. Off-Site Transportation Route

Figure 19 Off-Site Transportation Route of Contaminated Soil

As the start and end points of transportation are Ganshui site and Chongqing Lafarge Cement Plant respectively, the transportation route from Ganshui Town to the Plant can be determined as follows (Figure 19): Ganshui Site (start point)-- driving for 5.6 km along G210-- Dongxi Toll Gate (Lanzhou-Haikou Expressway G75)-- driving for 63 km in the direction towards Chongqing -- Pingtanzi Bridge-- ring expressway--driving for 14.9 km to Lafarge Cement Plant in Jiangjin District (end point). The whole course is about 83.5 km.

5.4.2. Environmental Risk Control in Transportation

(1) Protection of transport vehicles: the contaminated soil of Ganshui site are transported with dump trucks. Before entering the site, each dump truck should be refitted from the perspective of environmental protection and equipped with a cover plate and tarpaulin and should have been regularly overhauled;

(2) Odor control: it is required to take appropriate control measures based upon the compositions of the gas that may be produced, so as to protect the personnel and equipment at the Site;

(3) After completion of the construction or before used for transporting other materials, the transport vehicles of contaminated soil should be completely cleaned to prevent the contaminated soil from being transported to other places, resulting in secondary pollution.

(4) In transportation, the speed should be reduced to ensure safety when the vehicles pass through the environmental sensitive areas and protective areas, such as water reservoir, river, bridge, farmland and downtown road and the speed should be controlled below 15 km/h when the vehicles pass through the bends with the radian lower than 100 degrees. Besides, the

speed should not be higher than 70 km/h on expressways and not higher than 50 km/h on urban roads and country rods.

(5) In transportation, each transport vehicle should be equipped with one escort. All drivers and escorts should be well trained and have strong environmental awareness. In addition, the drivers and escorts should fill in the manifest and carry the driving permit, driving license and normal communication facilities in transportation;

(6) At peak hours, the quantity of transport vehicles dispatched should be controlled. Furthermore, it is required to communicate with competent departments in advance on the specially managed sections that the vehicles will pass through;

(7) Labor safety protection: the drivers and escorts should wear necessary protective articles, such as masks, protective clothing and gloves.

5.5. Plan for Storage of Contaminated Soil

According to the goal of the demonstrative project, the contaminated soil of Ganshui site will be disposed by the means of ex-situ treatment. The contaminated soil will be transported to and temporarily stored in the storage site of Chongqing Lafarge Cement Plant for disposal. Lafarge Cement Plant owns complete contaminated soil storage facilities and management practices and has gained Chongqing Business Permit for Hazardous Wastes. Therefore, it can collect, store and dispose of hazardous wastes. Relevant certificates of the Plant are shown in Annex 13 *Relevant Materials of Lafarge Cement Plant*.

(1) Storage site of Lafarge Cement Plant

In this scheme, the existing contaminated soil storage facilities of Lafarge Cement Plant (as shown in Figure 20) will be utilized. The storage site meets the following requirements:

- It is located in the area of stable geologic structure and its bottom is higher than the highest underground water level.
- The boundary of the site should be 800 m away from the nearest residential quarters and 150 m from the nearest surface waters.
- It is located in the downwind direction of the prevailing wind of nearby residential areas.
- It is not situated in a region of karst caves or an area susceptible to serious natural hazards, such as flood, landslide, debris flow and tide, etc..
- It is far from warehouses of dangerous goods (such as combustibles and explosives) and protection range of high-voltage transmission lines.

Figure 20 Storage Location of Lafarge Cement Plant for Contaminated Soil

(2) Structure of storage site of Lafarge Cement Plant

The storage site of Lafarge Cement Plant is provided with a complete anti-seepage system. As for the site, the structure is shown in Figure 21; the anti-seepage system is shown in Figure 22; and the internal structure and appearance are shown in Figure 23.

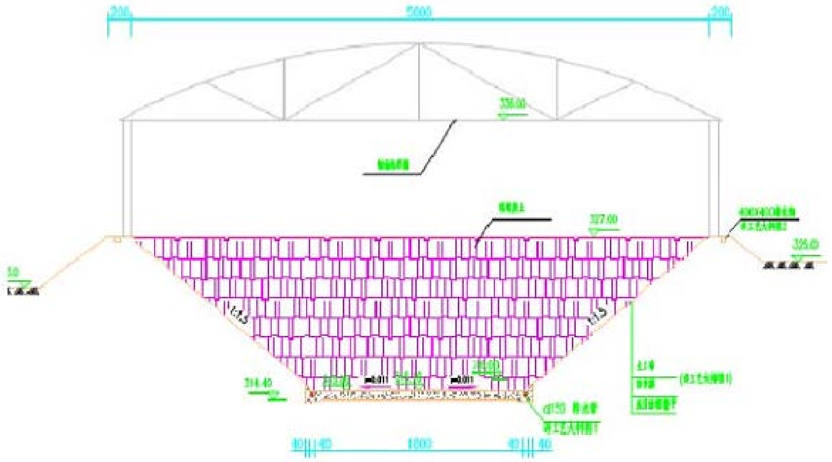


Figure 21 Contaminated Soil Storage Facility of Lafarge Cement Plant

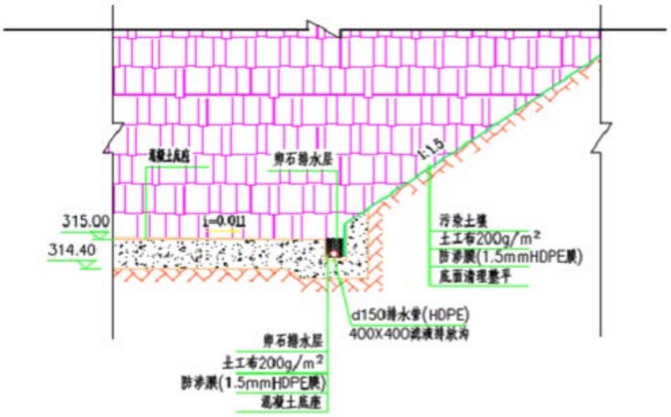


Figure 22 Anti-seepage System of the Contaminated Soil Storage Facility

Rainproof system: the storage site is of fully enclosed steel frame structure. On the roof, a special rainwater collection system is built and the collected rainwater will be directly discharged out of the site.

- Anti-seepage system: the ground is oblique to some extent and double-layer anti-seepage treatment is conducted for the ground. The inner sides of the walls are treated with high-density PE or PP. Meanwhile, a seepage detection system is installed under the ground. Once any seepage occurs, the system will give an alarm.
- The leachate produced by the POPs-contaminated soil is collected into a dedicated tank by the collection system and regularly pumped to the cement kiln via the main burner for incineration.
- A measure for preventing the leakage of harmful gas: in the storage facility, fully closed structure is adopted, including the wall, roof and ground.

Figure 23 Internal and External Views of the Contaminated Soil Storage

(3) Prevention and control of environmental risks

- Develop the Emergency Plan for Emergent Environment Incidents of the Project of Contaminated Soil Co-processing in Cement Kiln of Lafarge Cement Co., Ltd.;
- Set air vents connected with the atmosphere under the ceiling of the storage site;
- Construct drainage ditches around the storage site;
- Build an impervious concrete floor at the bottom of the storage site, and pave the floor with anti-seepage films, geotechnical clothes and sandbags from the bottom up; build several leachate drainage ditches in the middle;
- Build a 37.8 m^3 leachate pond;
- Establish appropriate standard operating procedure (SOP) in the storage site;
- Provide specialized protective clothing and masks for the front-line workers;
- Set a sanitary protection distance of 600 m. There is no resident within the specified area.

(4) Qualifications for storing contaminated soil by Chongqing Lafarge Cement Plant

Requirements on approval for environmental impact assessment of the “Production Line of Contaminated Soil Co-processing in Cement Kiln” of Chongqing Lafarge Cement Plant (Yu (Shi) Huan Zhun [2009] No. 224): for a 30,000 m^3 contaminated soil storage site, it is required to build ceiling and water collection and drainage facilities; comply with the requirements for Class-II Site in the *Standard for Pollution Control on the Storage and Disposal Site for General Industrial Solid Wastes* (GB18599- 2001) and the requirements of the *Standard for Pollution Control on Hazardous Waste Storage* (GB18597-2001). In addition, it is also required to build a 27.5 m^3 regulating tank to collect the leachate from the contaminated soil storage site. For the tank, anti-seepage treatment should be conducted. The leachate in the tank should be regularly transported to a qualified unit for incineration.

(5) Current conditions of contaminated soil storage of Chongqing Lafarge Cement Plant

- Reception and disposal of contaminated soil from Chongqing Tianyuan General Chemical Plant: the storage site has received and disposed of 30,000t high-risk soil contaminated by POPs, VOCs and SVOCs from this plant.
- Reception and disposal of contaminated soil from Chongqing Pesticide & Chemical Industry (Group) Co., Ltd.: the storage site has received and disposed of 30,000 t extremely high-risk soil contaminated by BHCs and DDTs from this company.
- Reception and disposal of contaminated soil from No. 1.2 Plot located at Gaojiu Road, Yuzhong District of Chongqing : the storage site has received and disposed of 1,600 t soil contaminated by TPHs from this plot.

(6) Cases concerning temporary storage of contaminated soil by Chongqing Lafarge Cement Plant

The environmental impact assessment for construction of the temporary storage site of Chongqing Lafarge Cement Plant has been approved by Chongqing Municipal Environmental

Protection Bureau (Yu (Shi) Huan Yan [2011] No. 109). The storage site has ever temporarily stored the contaminated soil from Chongqing Tianyuan General Chemical Plant, Chongqing Pesticide & Chemical Industry (Group) Co., Ltd. and No. 1.2 Plot located at Gaojiu Road, Yuzhong District of Chongqing . But it produced no ecological pollution on the surface water, underground water, soil and plants of Lafarge Cement Plant and the surrounding area, no odor and dust and no adverse impact on humans (employees and nearby residents). The complexity of pollutants and the degree of pollution of the contaminated soil from Chongqing Pesticide & Chemical Industry (Group) Co., Ltd. is much higher than that from Ganshui Site.

It can be seen that Chongqing Lafarge Cement Plant has the qualification and capacity for temporarily storing the contaminated soil of Ganshui Site.

(7) Temporary storage of contaminated soil of Ganshui Site

The storage of the contaminated soil of Ganshui site should be subject to the rules and regulations of the Lafarge Cement Plant:

- The contaminated soil of Ganshui site should be well packaged (in leak-proof bags or sealed barrels) and should not be mixed with other soil;
- The contaminated soil should be attached with labels, indicating the name, source, quantity, properties, packaging container, warehouse-in date, storage location, warehouse-out date, receiving unit and operating requirements;
- The storage units should be separated and each unit should be provided with a leak-proof apron or leakage storage tray made of materials compatible with the soil;
- The bags filled with contaminated soil can be stacked for storage. But spaces should be left among the piles for handling;
- The storage site should be equipped with dedicated handling machineries. Within the site, handling routes and operating areas should be designed.

5.6. Technical Scheme for Contaminated Soil Remediation

5.6.1. Techniques Screening for the Remediation of Contaminated Soil

5.6.1.1. Requirements and Principles of Techniques Screening

The selection of remediation technique is one of the decisive factors that affect the success of contaminated site remediation, and the multiple factors should be taken into consideration, including the type and concentration of target pollutants, remediation target, future land use planning, remediation time and cost, availability and reliability of the techniques, equipment configuration and construction of auxiliary projects.

As for Ganshui site, it is planned to remove the contaminated soil and building surfaces and transport them to the specialized disposal sites. The target values of remediation are as follows: As content: not higher than 20 mg/kg; α-BHC content: not higher than 0.20 mg/kg; β-BHC content: not higher than 0.22 mg/kg.

In addition to the techniques applicability and the site actual situation, environmental supervision during the remediation should also be considered. In general, the remediation technique should be selected according to the following principles:

(1) Technical feasibility

The ultimate purpose of contaminated site remediation is to protect human health. Therefore, the remediation technique selected should be capable of lowering the concentration of target pollutants below the target values within a specified period;

The remediation technique should be mature and adapted to the soil lithology and hydrogeological conditions;

The soil of the contaminated site usually contains both organic and inorganic pollutants; hence, the remediation technique should be capable of removing both of them.

(2) Strong operability

The remediation technique should meet the conditions for application in projects in China: necessary auxiliary facilities and equipment. Furthermore, there should be experienced technical personnel and management personnel familiar with the application of the technique.

(3) Ease for supervision in remediation

In order to reduce the supervision time and cost of the competent department and prevent the potential environmental and safety risks to the maximum extent, the remediation technique selected should be able to successfully remediate all contaminated soil according to relevant standards in a short time.

For the remediation technique selected, there should be applicable measures for control of secondary pollution; the emission of waste gas, wastewater, solid waste and noise should comply with national and local standards; complete safety and health supervision systems and relevant rules and regulations should have been established.

(4) Giving priority to the remediation technique requiring low cost

Among the feasible remediation techniques that meet the conditions (1), (2) and (3), it is recommended to give priority to the technique requiring low cost.

(5) Separate disposal

Those soils with the different pollutants and different risk levels should be separately disposed by appropriate remediation techniques according to the future land use planning.

5.6.1.2. Investigation on contaminated soil remediation techniques

As the mainly contaminants of Ganshui site were As, α-BHC and β-BHC, the investigated techniques that commonly used in the **US Superfund** projects were also focused on the pesticide -contaminated (such as α-BHC and β-BHC) sites and As-contaminated sites. The investigation results are shown in Figure 24 and Figure 25.

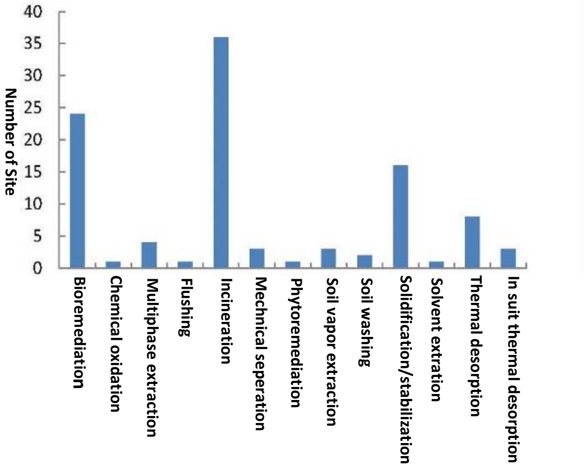


Figure 24 Statistics of Remediation Techniques for Pesticide-contaminated Sites

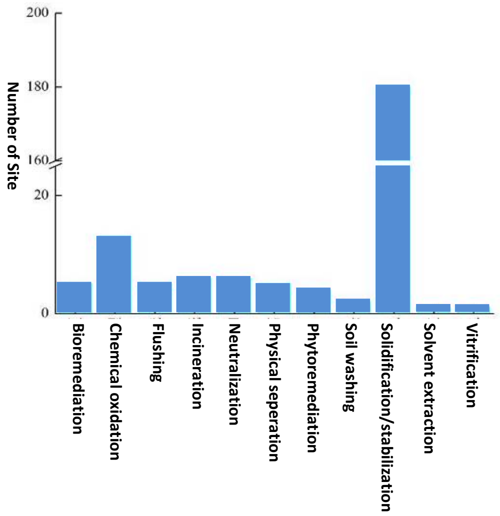


Figure 25 Statistics of Remediation Techniques for Heavy Metal Contaminated Sites

It can be found from Figure 24 that for US Superfund pesticide-contaminated sites, the remediation techniques commonly used include incineration, bioremediation and solidification & stabilization techniques for remediation, which account for 35.0%, 23.3% and 15.5% respectively, and for heavy metal contaminated sites, the solidification & stabilization technique is often utilized, with the application rate up to 78.6% (Figure 25). For the specific and commonly used in-situ and ex-situ remediation techniques, the information of the principle, efficiency, cost, advantages & disadvantages and application conditions, are as shown in Table 25.

In addition, US EPA also summarizes the remediation techniques for POPs-contaminated soil. Specifically, the techniques can be divided into application techniques in projects, demonstration techniques in pilot test and lab-scale experimental techniques, as shown in Table 26.

- Application techniques in projects mainly refer to the remediation techniques that have been successfully applied in practical projects. These techniques are more mature, stable and reliable and they usually have been accepted by relevant administrative departments;
- Demonstration techniques in pilot test refer to the techniques at demonstration stage, of which the engineering application effects should be further verified. These techniques are of a certain degree of uncertainty in remediation effect; therefore, feasibility study is needed before they are applied in projects;
- Lab-scale batch tests have played an important role in studying the key factors affecting the remediation effects of techniques and determining the technical feasibility of the techniques. In general, lab-scale experimental techniques are of great uncertainties. There may be many problems that need to be solved if they are applied in projects.

Table 25 Remediation Techniques Commonly Used for Contaminated Sites

In-situ technique				
Remediation technique	Technical principle	Applicability	Restriction	Cost [5]
Washing	Add some fresh water or the water containing additives that may improve the solubility of pollutants to the soil or underground water and then raise the underground water level to the contaminated soil area. In this way, pollutants will be leached to the underground water and then extracted and disposed.	● This technique is applicable to in-situ removal of halogenated SVOCs, non-halogenated SVOCs, PCBs and explosives. ● Water-soluble inorganic pollutants can be eliminated through soil washing. ● When pollutants extend to the underground water level, this technique is most applicable.	● It is required to collect leachate. ● It is of great difficulty to dispose of low-permeability soil. ● The surfactant may adhere to the soil, reducing the soil porosity. ● The reaction of the liquid used for soil washing may reduce the mobility of the pollutants. ● The washing liquid should be remedied and treated to meet the emission standard.	33~$327/m^3
Vapor extraction	Soil vapor extraction (SVE) is a kind of in-situ remediation technique applicable for the soil in non-saturated region. It generally produces a pressure/concentration gradient by vacuuming so as to make the gas volatiles diffuse to the extraction well from the soil. In this process, a waste gas treatment system is involved. This technique is also named in-situ soil venting, in-situ volatilization, volatility improvement or soil vacuum extraction.	● This technique is usually applicable to the remediation of the soil contaminated by VOCs with the Henry's constant of over 0.01 or the steam pressure of over 0.5 mmHg. Extraction can improve the mobility of oxygen in soil; therefore, in-situ biodegradation may be improved when low-VOCs exist.	● Compact soil or the soil with high water content (>50%) may reduce the air or vacuum permeability (increase cost) and/or restrain the operation of SVE. ● For the soil with high variability, the extraction well should have large screening gap; otherwise, airflow may not be transmitted evenly. ● Extremely dry soil or the soil with high organic content has strong VOC absorption capacity, which reduces the clearing speed. ● The offgas exhausted should be treated so as to eliminate the potential hazard on the environment and human. ● The active carbon used to absorb waste gas should be treated uniformly. ● SVE is inapplicable in the saturated regions.	$10~$50/m^3
Solidification/stabilization	Solidify the pollutants in the soil through a certain amount of solidifiers/ stabilizers, so as to reduce the mobility and volatility of pollutants.	● This technique is applicable to SVOCs, PAHs, PCBs, pesticides, heavy metals and cyanides of any form.	● The depth of pollutants may restrict the application of this technique. ● Solidification/stabilization may increase the volume of contaminated soil. ● It needs advanced technologies and high cost to transmit the solidifiers/ stabilizers to the specified depth and make them fully mixed with the contaminated soil. ● In remediation, it is of great difficulty to conduct supervision and sampling.	About $220/m^3
In-situ chemical oxidation	Inject chemical agents into the contaminated soil through injection wells so as to realize oxygenolysis of pollutants.	● This technique is applicable to VOCs, PAHs, pesticides, PCBs and phenolic resins.	● A large amount of chemical oxidants are needed to treat the soil contaminated by lots of organic pollutants. ● The oxidized organic pollutants may produce more toxic substances after degradation.	$281~$289/m^3

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[5] Remediation Technology Screening Matrix and Reference Guide, Version 4.0, The Federal Remediation Technologies Roundtable (FRTR).

			● Some organic pollutants cannot be oxidized.	
In-situ thermal treatment	Heat the contaminated soil through a heat conduction system so as to promote the volatilization of pollutants and then collect the volatilized pollutants for centralized disposal through an air-bleed system.	● This technique is applicable to many organic pollutants, such as VOCs, PAHs, PCBs and pesticides.	● Debris or other large substances in the medium may cause difficulty in operation. ● Thermal treatment applying different maximum temperatures and/or treatment methods may be applicable to different pollutants. ● The soil structure may be changed based upon the treatment method selected. ● Compact soil or the soil with high water content may reduce the air permeability and impede the operation of the enhanced SVE. Therefore, more energy should be imported to improve the vacuum degree and temperature. ● High-permeability and high-variability soil may result in unbalanced airflow. ● The soil with high organic content has strong VOC absorption capacity, which may affect the remediation effects. ● The exhaust gas should be treated so as to avoid the damage on the environment and human. This process may increase the project cost. ● Residual liquid and the used active carbon should be further disposed. ● This technique is not applicable in saturated regions.	\$246~\$286/m^3
Ex-situ technique				
Remediation technique		Applicability	Restriction	
Thermal desorption	Properly screen and pre-treat the excavated contaminated soil, indirectly or directly heat the soil with a heating furnace to desorb pollutants into gas state, and then collect the pollutants with collection devices for centralized disposal.	● This technique is applicable to VOCs, PAHs, ethylbenzene, xylene, phenol, cyanide of any form, POPs and pesticides.	● This technique has specific requirements in terms of grain size and physical properties of the soil, which may affect its applicability and remediation cost. ● Pretreatment is needed to reduce the water content of the soil. ● Clay and the soil with high organic content may require more thermal desorption time.	\$81~\$252/m^3
Incineration	Incinerate the pollutants in soil (in presence of oxygen) in a cement kiln or specialized soil incineration device at the temperature of 871-1,204°C.	● It is applicable to POPs, especially PCBs. ● It is economical for bulk processing.	● It requires high cost if there is only a small amount of contaminated soil to be treated. ● The dust produced by incineration needs to be further disposed.	\$220~\$1100/m^3
Chemical oxidation	Convert the harmful pollutants into more stable, less active/inert and harmless low-toxicity compounds through oxidation reaction. The oxidants most commonly used include ozone, hydrogen peroxide, hypochlorite, chlorine and chlorine dioxide.	● This technique is applicable to non-halogenated VOCs and SVOCs, hydrocarbons and insecticides.	● It may produce incompletely oxidized pollutants or intermediate products which may have higher toxicity. ● For high-concentration pollutants, a large number of oxidants are needed. ● Oil solvents in the soil may affect the efficiency of chemical oxidation of target pollutants.	\$190~\$660/m^3

Table 26 Non-incineration Technique for Chlorinated Organic Compounds Contaminated Soil

Technique	Technical principle	Current status	Applicable pollutant	Applicable contaminated media	Pollution intensity	Treatment efficiency [6]				Ex-situ or in-situ
						Pollutant	Initial concentration (mg/kg)	Concentration after treatment (mg/kg)	Removal efficiency	
Dried blood-enhanced anaerobic biodegradation	Mix the contaminated soil and water into slurry, add a certain amount of dried blood and maintain the anaerobic environment to promote the microbial dechlorination and degradation of target pollutants.	Engineering Demonstration	Pesticides containing chlorine	Soil and sediment	Low concentration	Toxaphane	29-34	4-5	86-93%	Ex-situ
							23-110	5-20	66-82%	
Base catalytic decomposition	Replace the chlorine in the pollutants with hydrogen at high temperature and high pressure by utilizing alkali salt (such as sodium salt) as catalyst and providing hydrogen donor, so as to achieve the goal of dechlorination and detoxication. When this technique is used to treat the contaminated soil or solid wastes with the concentration of ppm, it is required to conduct thermal desorption pretreatment for the contaminated soil or wastes so as to desorb the target pollutants, then gather the pollutants with enrichment and finally conduct base catalytic decomposition for the enrichment.	Engineering application	PCBs and DDTs, etc.	Soil and liquid pollutant	Low to high concentration	PCBs	81100	<5	99.99%	Ex-situ
DARAMEND	Alternatively maintain oxygen-deficient environment and aerobic environment and add DARAMEND (a kind of organic amendment) to promote the degradation of target pollutants by the microorganisms in the soil.	Engineering application	Toxaphane and HCBs	Soil and mud	Low concentration	Toxaphane	189 (mean value)	10 (mean value)	89%	Ex-situ
						DDTs	81 (mean value)	9 (mean value)	90%	
Vitrification	Heat the contaminated media to high temperature (1,800-2,000°C) and decompose the pollutants. Some pollutants may remain in the molten residues, which greatly lowers the activity of pollutants. Therefore, there should be complete exhaust gas collection and disposal devices.	Engineering application	Dieldrin, chlordane, heptachlor, DDTs, HCBs, PCBs and dioxin	Soil and sediment	Low to high concentration	DDTs	340 (Maximum)	<0.016	99%	Ex-situ
						Chlordane	89 (Maximum)	<0.08	99%	
Mechano-chemical dechlorination	Stir the target pollutants and antichlor by virtue of the chemical force generated by the equipment operating at high speed to facilitate the reductive dechlorination of the pollutants and antichlor and	Engineering application	DDTs, dieldrin, lindane and PCBs	Soil, sediment and liquid pollutant	Low to high concentration	Aldrin, dieldrin and lindane	73.24 (mean value)	20.61 (mean value)	71.86%	Ex-situ

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[6] Reference Guide to Non-combustion Technologies for Remediation of Persistent Organic Pollutants in Soil, Second Edition -2010, EPA 542-R-09-007.

	consequently achieve the goal of detoxication.					DDT, DDD, DDE	717 (mean value)	64.8 (mean value)	90.96%	
Radicalplanet technology	The working principles of this technique are similar to those of mechano-chemical dechlorination. But, for this technique, planetary ball mill rotating at high speed is generally used as the reaction vessel. The contaminated soil is mixed with antichlor (such as base heavy metals) and then placed into the reaction vessel. Under high-speed revolution and the collision of the grinding balls, dechlorination reaction occurs, thus achieving the goal of detoxication.	Engineering application	PCBs, DDTs, chlordane and dioxin, etc.	Soil, sediment and fly ash	Low to high concentration	PCBs	42800	0.01	99.99%	Ex-situ
Acoustic wave technique	Elute the pollutants in the soil with solvents, transfer the eluent containing pollutants to the reaction vessel filled with base heavy metal and then facilitate dechlorination through specialized LF acoustic wave generator.	Engineering application	PCBs	Soil	Low to high concentration	PCBs	400-1600	<25	98.43%	Ex-situ
Thermal desorption	Properly screen and pre-treat the excavated contaminated soil, indirectly or directly heat the soil with a heating furnace to desorb pollutants into gas state, and then collect the pollutants with collection devices for centralized disposal.	Engineering application	PCBs and dioxin	Soil and sediment	Low to high concentration	PCBs	10000	<10	100%	Ex-situ
Phytoremediation	Absorb pollutants by using plants. The root exudates of plants can promote the degradation of pollutants by mycorrhiza microorganisms.	Demonstration	DDTs, PCBs and chlordane	Soil and sediment	Low concentration	/	/	/	/	In-situ
Thermal reduction and sodium dispersion technique	This technique can be divided into two steps: firstly, heat the contaminated media to 350°C-600°C in oxygen-free condition by using indirect pyrolysis technology to desorb the pollutants in the soil, and then collect the gaseous pollutants with oil phase; secondly, add metal sodium to the oil phase containing pollutants and heat the oil phase to 90°C so as to decompose target pollutants through reaction.	Demonstration	DDTs, PCBs, chlordane, BHCs and dioxin	Soil	Low to high concentration	/	/	/	/	Ex-situ

Subcritical water oxidation	Firstly extract target pollutants from soil with solvents, and then heat the target pollutants to 370°C together with hot water, sodium hydroxide solution, high-pressure oil and oxy-reactants in a high-temperature and high-pressure reaction vessel and raise the pressure to 26.7 MPa at the same time.	Demonstration	Dieldrin, PCBs and dioxin	Soil	/	/	/	/	/	Ex-situ
High-temperature self-propagating dechlorination	Mix the contaminated soil with calcium hydride or calcium salt, put the mixture into the reaction vessel which is provided with tungsten filament, hold the pressure in the reaction vessel at a certain level with argon, and trigger an exothermic reaction through electric pulse. Due to the reaction, the temperature in the system reaches 1,400°C. At this temperature, HCB will be finally reduced to hydrocarbon.	Small-scale test	Hexachlorobenzene (HCB)	Soil	High concentration	/	/	/	/	Ex-situ
TDT-3R	Heat the contaminated media to 300-350°C in a rotary kiln to desorb pollutants in the soil, collect gaseous pollutants with an exhaust gas collection system and then transfer them to a thermal oxidizer for high-temperature incineration (1,250°C).	Small-scale test	Hexachlorobenzene (HCB)	Soil	High concentration	HCB	1215	0.1	99.99%	Ex-situ

5.6.1.3. Screening of Remediation Techniques for BHC-Contaminated Soil

The techniques screened are mainly used for the remediation of the contaminated soil excavated. The screening range only includes the mature ex-situ remediation techniques that have been successfully applied in industrialized applications. Upon the investigation on the domestic and overseas contaminated site remediation cases, it is found that there are many techniques applicable to remediation of the soil contaminated by pesticides, such as BHC. The process for screening the remediation techniques for BHC-contaminated soil at Ganshui site is shown in Table 27.

Table 27 Screening of Remediation Techniques for BHCs-contaminated Soil

NO	Technique	Technical feasibility	Operability	Existing conditions in Chongqing	Remediation cost [7]	Screening result
1	Solidification/stabilization	This technique is designed to stabilize the pollutants in the soil with specific stabilizers, so as to lower the activity of the target pollutants and consequently reduce the environmental risk. It is applicable to the treatment and disposal of medium- and high-concentration heavy metals and organic pollutants. Even though it has been successfully applied in remediation of US Superfund pesticide-contaminated sites, there is still no successful case in China. Due to the effect of several factors, such as soil property, the remediation result of this technique is of a certain degree of uncertainty. Therefore, it is necessary to landfill the solidified wastes safely.	Currently, this technique has not yet been tested or applied in any pilot test or project; however, it can be easily implemented and managed and relevant equipment has been successfully developed in China. Therefore, the technique is operable and can be applied in relevant projects on the premise of confirmed technical feasibility.	1) Due to non-compliance with the hazardous waste standard, the contaminated soil cannot be disposed in the hazardous waste landfill. Moreover, there is not sufficient hazardous waste landfill in Chongqing now and only the wastes free from BHC can be allowed to enter MSW landfills. At present, Chongqing has not yet established complete safety landfill standard or specification; 2) under the existing monitoring conditions in Chongqing, it is impossible to realize separate collection and long-term monitoring and assessment of leachate; 3) there is no proven commercial solidifier/stabilizer in China. Therefore, solidification/stabilization technique is not applicable to contaminated soil remediation of the Project.	About $220/m^3	N/A
2	Anaerobic biodegradation	This technique is applicable to the degradation of low- and medium-concentration organic pollutants. At abroad, it has been applied in the remediation engineering of the soil contaminated by or the sediment containing low-concentration toxaphene or DDT. Due to the effect of soil property, the remediation result of the technique should be determined at site. Meanwhile, it is required to further consider slurry dewatering and follow-up disposal process. Therefore, anaerobic biodegradation is of great uncertainty in application in soil remediation of the Project.	Currently, this technique has not yet been tested or applied in any pilot test or project. But it requires simple equipment and can be easily implemented and managed. Therefore, it is operable and can be applied in relevant projects in China.	1) Chongqing has an annual average temperature of 18°C and high humidity. Therefore, microbial degradation of pollutants is applicable there; 2) the utilization of this technique has been supervised for a long term; 3) the bioremediation technique may cause little secondary environmental pollution; 4) In Ganshui Site, the soil has been contaminated for a long time; hence, there is pesticide-resistant microorganism and degrading microorganism in the soil.	$130~$271/m^3	Probably applicable (need further test)
3	Soil washing	1) Applicable to the soil contaminated by high-concentration heavy metal; non-applicable to hydrophobic organic pollutants; 2) applicable to contaminated sandy soil; non-applicable to contaminated clayed/powdered soil; 3) the washing wastewater should be further treated. Therefore, the soil washing technique is technologically infeasible in remediation of BHC-contaminated soil in the Project.	Currently, the technique has been tested in pilot tests. It can be simply implemented and managed and the required equipment can be produced at home. Therefore, this technique is operable and can be applied in relevant projects.	1) In Chongqing, the soil is mainly comprised of red clay. Therefore, soil washing is not applicable; 2) due to long aging time of the pesticide-contaminated soil, soil washing is of low-efficiency in Ganshui Site; 3) the main pollutant in Ganshui Site is BHC, which is a kind of hydrophobic organics. Thus, soil washing is not applicable; 4) as soil washing has	$358~$361/m^3	N/A

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[7] Remediation Technology Screening Matrix and Reference Guide, Version 4.0 , The Federal Remediation Technologies Roundtable (FRTR)

				not yet been applied in contaminated soil remediation in Chongqing, there is a lack of regulatory experience.		
4	Thermal desorption	This technique is applicable to remediation of all kinds of organic contaminated soil, especially the soil contaminated by high- and medium-concentration pollutants. With good remediation effect and high organic removal rate, it can almost remove pollutants completely. Currently, the technique has been mature and relevant equipment has been successfully produced at home. Therefore, it is technologically applicable to contaminated soil remediation of the Project.	Currently, the technique has been applied in relevant engineering and relevant thermal desorption equipment has been successfully produced at home. The technique may cause little secondary environmental pollution. In addition, we have accumulated certain regulatory experience.	1) At present, industrial-scale thermal desorption equipment is not available in Chongqing; 2) leased thermal desorption equipment needs long time for transportation, installation and debugging and Ganshui Site has only a small amount of contaminated soil. Therefore, this technique is not operable and cannot be applied in projects in Chongqing.	$\$81\sim\$252/m^3$	N/A
5	Incineration	This technique is applicable to remediation of all kinds of organic contaminated soil, especially the soil contaminated by high- and medium-concentration pollutants. With good remediation effect and high organic removal rate, it can almost remove pollutants completely. Currently, the technique has been mature and successfully applied in large-scale projects in China, especially in Chongqing and relevant equipment has been successfully produced at home. Therefore, it is technologically applicable to contaminated soil remediation of the Project.	Currently, this technique has been successfully applied in relevant projects, with high daily processing capacity. It may cause little secondary environmental pollution and relevant operation and management technologies have been mature. Therefore, this technique is operable and can be applied in relevant projects.	1) In Chongqing, cement kiln incineration facilities have been built and rich practical experience in disposal of the soil contaminated by high-concentration pollutants has been accumulated; 2) Chongqing has established sound regulatory system for incineration of contaminated soil.	$\$220\sim\$1100/m^3$	Applicable (need no test)
6	Chemical oxidation	This technique is applicable to the remediation of all kinds of organic contaminated soil. However, the soil of the Project is of high organic content, which may affect the remediation effect. If chemical oxidation is applied in the Project, chlorinated organics may easily generate dioxins with higher toxicity. Besides, chemical oxidation is often conducted in mud system and it is required to further consider the issues related to soil dewatering and disposal of mud cake after remediation. Therefore, the chemical oxidation technique is not applicable to contaminated soil remediation of the Project.	Currently, this technique has been tested in pilot tests. It can be simply implemented and managed and the required equipment can be produced at home. Therefore, this technique is operable and can be applied in relevant projects in China.	1) The soil in Chongqing belongs to clayed soil which has buffering effect for chemical agents. Thus, a large amount of chemical oxidizer is needed in chemical oxidation; 2) In China, this technique has not yet been well applied in the projects and it may easily cause secondary environmental pollution; 3) after treatment, the soil should be landfilled due to poor utilizability. However, the landfills in Chongqing have low available capacity; 4) the environmental regulatory requirements related to contaminated soil remediation cannot be met in Chongqing.	$\$190\sim\$660/m^3$	N/A
7	Chemical gas reduction	This technique is applicable to the remediation of all kinds of contaminated soil, especially the soil contaminated by high- and medium-concentration organic pollutants. It is of good remediation effect and requires short time for remediation. Therefore, this technique is technologically applicable to soil remediation of the Project.	This technique has not yet been tested or applied in any pilot test or project. It needs complicated equipment that should be manufactured with sophisticated technologies and there is insufficient auxiliary equipment and qualified engineering technicians for the technique. In treatment, the main reaction equipment operates under high temperature and high	Due to a lack of engineering application in China, the potential secondary environmental pollution of the technique is unclear. But it is predicted that secondary pollution may be easily caused because of inadequate experience in supervision of remediation.	The data of the cost of this technique is not yet available. But large investments in equipment are needed at the early stage. It is estimated that the treatment	N/A

			pressure, which may result in certain safety risk. In such case, the operating managers should have high ability and good skills. Currently, this technique is not operable and cannot be applied in projects in China.		plants of two treatment systems needs USD 10 million. Therefore, this technique is technologically non-applicable to contaminated soil remediation of the Project.	
8	Vitrification	This technique is applicable to the remediation of all kinds of contaminated soil, especially the soil contaminated by high-concentration heavy metals or organics. It is of good remediation effect and requires short time for remediation. Therefore, this technique is technologically applicable to soil remediation of the Project.	This technique has not yet been tested or applied in any pilot test or project. For the technique, there is insufficient auxiliary equipment and qualified engineering technicians. Furthermore, this technique needs complicated equipment which should reach extremely high temperature within a short period. It is hard to develop and produce such equipment in a short term in China. Currently, this technique is not operable and cannot be applied in projects in China.	1) Due to a lack of engineering application in Chongqing, the potential secondary environmental pollution of the technique is unclear; 2) there is a lack of experience in supervision of remediation; 3) vitrification requires high cost.	Public data of the cost of this technique is not yet available. But the heating temperature required by this technique in operation is about 1,800-2,200°C, requiring high energy consumption. It is preliminarily predicted that the cost of this technique is higher than that of the conventional thermal desorption technique.	N/A
9	Mechano-chemical dechlorination	This technique is applicable to the remediation of all kinds of contaminated soil, especially to the treatment of high- and medium-concentration non-degradable POPs. It is of good remediation effect and requires short time for remediation. Therefore, this technique is technologically applicable to soil remediation of the Project.	This technique is of high remediation effect and free from secondary pollution. The auxiliary equipment covers only a small area. Therefore, it is operable.	1) This technique has not yet been well applied in relevant engineering and there is no proven auxiliary mechanical equipment in China; 2) the potential secondary environmental pollution of the technique is unclear; 3) in Chongqing, there is a lack of relevant technical reserves and experience in supervision of remediation.	Public data of the cost of this technique is not yet available.	Probably applicable (need further test)
10	Acoustic wave technique	This technique is applicable to the remediation of all kinds of contaminated soil, especially the soil contaminated by high-concentration organic pollutants. When it is applied, the pollutants should not have too high boiling point and too	This technique has not yet been tested or applied in any pilot test or project. For the technique, there is insufficient auxiliary equipment and	1) This technique has not yet been well applied in relevant engineering and there is no proven auxiliary mechanical equipment in China; 2) the potential	Public data of the cost of this technique is not	N/A

		complex chemical structure. This technique is of good remediation effect and requires short time for remediation. Therefore, it is technologically applicable to soil remediation of the Project.	qualified engineering technicians. Furthermore, the technique requires complicated equipment, thus the operating managers should have high ability and good skills. It can be seen that this technique is not operable and cannot be applied in projects in China.	secondary environmental pollution of the technique is unclear; 3) in Chongqing, there is a lack of relevant technical reserves and experience in supervision of remediation.	yet available.	
11	Phytoremediation	Phytoremediation technique is applicable to the remediation of the soil mildly contaminated by heavy metals or organics. In foreign countries, demonstration projects of this technique have been implemented. However, as the remediation effect may be influenced by many factors, such as soil property, it is required to conduct further test before this technique is applied in contaminated soil remediation of the Project so as to reduce uncertainty.	At present, this technique has not yet been applied in any demonstration project in China. But the equipment required by this technique is agricultural machinery which can be operated and managed easily. Therefore, this technique is operable and can be applied in relevant projects.	1) Chongqing has an annual average temperature of 18°C and high humidity. Plants can grow well there; 2) the utilization of this technique has been supervised for a long term; 3) this technique may cause little secondary environmental pollution.	$10~$60/t	Probably applicable (need further test)

It can be found from Table 27 that for BHC-contaminated soil of Ganshui site, the incineration technique meets the requirements on technical feasibility, operability, remediation supervision and remediation cost. Meanwhile, this technique can be directly used for soil remediation without further technical feasibility test.

Thermal desorption technique also meets the requirements on technical feasibility, remediation supervision and remediation cost, and does not need further technical test as well. But currently, industrial-scale thermal desorption equipment is not yet available in Chongqing and leased equipment needs long time for transportation, installation and debugging. Furthermore, Ganshui site has only a small amount of contaminated soil. For this project, therefore, the thermal desorption technique is not operable.

According to the overall requirements of the project, the soil properties of Ganshui site and the reserves of remediation techniques in Chongqing, it is determined that incineration, anaerobic biodegradation and phytoremediation conforms to the principles of high operability, ease for supervision and low remediation cost. Among them, anaerobic biodegradation and phytoremediation have been successfully applied in projects in USA and some European countries. However, they have not yet been applied in China, requiring an in site test for the remediation effect. For other techniques, there is a lack of successful cases, auxiliary facilities and qualified management personnel and technical personnel in China, even though they have been widely applied in foreign countries. By applying these techniques, the remediation project of Ganshui site cannot be successfully completed in a short time. Therefore, these techniques are not applicable to the contaminated soil remediation of the Project.

5.6.1.4. Screening of Remediation Techniques for As-Contaminated Soil

According to the actual conditions of As-contaminated soil and the commonly used As remediation techniques and technique screening principles, the remediation techniques for As-contaminated soil of Ganshui site are screened as shown in Table 28.

Table 28 Screening of Remediation Techniques for As-contaminated Soil

NO.	Techniques	Technical feasibility	Operability	Existing conditions in Chongqing	Remediation costs [8]	Screening Result
1	Solidification/stabilization	This technique is designed to stabilize the pollutants in the soil with specific heavy metal stabilizers, so as to lower the activity of the target pollutants. It is mainly used for remediation of the soil contaminated by high- and medium-concentration heavy metals or organic pollutants. In China, solidification/stabilization technique has been successfully applied in remediation engineering of As-contaminated soil. Therefore, this technique is technologically feasible in As-contaminated soil remediation of the Project. However, it is required to screen and test the stabilizers and understand relevant parameters, such as dose, before implementation and then landfill the solidified wastes after remediation.	Currently, the technique has ever been applied in relevant projects. It can be simply implemented and managed and the required equipment can be produced at home. Therefore, this technique is operable and can be applied in relevant projects.	1) Due to non-compliance with the hazardous waste standard, the contaminated soil cannot be disposed in the hazardous waste landfill. Moreover, there is not sufficient hazardous waste landfill in Chongqing now and only the wastes free from BHC can be allowed to enter MSW landfills. At present, Chongqing has not yet established complete safety landfill standard or specification; 2) under the existing monitoring conditions in Chongqing, it is impossible to realize separate collection and long-term monitoring and assessment of leachate; 3) there is no proven commercial solidifier/stabilizer in China. Therefore, solidification/stabilization technique is not applicable to contaminated soil remediation of the Project.	About $220/m3	N/A
2	Chemical treatment	This technique is designed to change the form of the heavy metals in soil with specific chemical agents. It is mainly used for remediation of the soil contaminated by high-concentration and high-valence heavy metals. Therefore, it is technologically applicable to As-contaminated soil remediation of the Project. However, it is required to further determine the form of As in soil and carefully select appropriate chemical agents.	Since this technique has not yet been applied in demonstration projects, there is a lack of information related to the technique. Therefore, this technique is of great uncertainty in operability.	1) The soil in Chongqing is mostly acid. In chemical treatment, the soil should be transformed to alkaline status. Therefore, chemical treatment is not applicable; 2) In China, this technique has not yet been applied in projects and it may easily cause secondary environmental pollution; 3) after treatment, the soil should be landfilled due to poor utilizability. However, the landfills in Chongqing have low available capacity; 4) the environmental regulatory requirements related to chemical treatment of contaminated soil	$190~$660/m^3	N/A

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[8] Remediation Technology Screening Matrix and Reference Guide, Version 4.0, The Federal Remediation Technologies Roundtable (FRTR).

				cannot be met in Chongqing.		
3	Incineration	In general, cement kiln is used for incineration in implementation of this technique. The heavy metals in the soil are in molten state at high temperature and then are embedded in the lattice of cement after cooling. This technique is applicable to treatment of the soil contaminated by high-concentration pollutants. At present, cement kiln co-processing technique has been successfully applied in many projects of disposal of waste and soil containing heavy metals. Therefore, this technique is technologically feasible in As-contaminated soil remediation of the Project.	This technique has been successfully applied in projects; relevant cement kiln co-processing facilities have been manufactured; and relevant managers are skilled. Therefore, this technique is operable.	1) In Chongqing, cement kiln incineration facilities have been built and rich practical experience in disposal of the soil contaminated by high-concentration pollutants has been accumulated; 2) Chongqing has established sound regulatory system for incineration of contaminated soil.	\$220~\$1100/m^3	Feasible (need no test)
4	Phytoremediation	This technique is designed to gather As in the soil by virtue of ciliate desert-grass. It is applicable to the soil contaminated by low- and medium-concentration pollutants. At present, demonstration projects of this technique have been implemented. However, this technique may be affected by local soil property and climate. When applied in As-contaminated soil remediation in the Project, it is of great uncertainty in feasibility. Therefore, further test is needed.	Currently, demonstration projects of the technique have been implemented. Meanwhile, the technique requires simple auxiliary equipment and can be simply implemented and managed. Therefore, it is operable.	1) Chongqing has an annual average temperature of 18°C and high humidity. Plants can grow well there; 2) the utilization of this technique has been supervised for a long term; 3) this technique may cause little secondary environmental pollution; 4) it is of great importance to properly dispose the hyperaccumulators absorbing heavy metals. Therefore, this technique is applicable to remediation of As-contaminated soil in the Project.	\$10~\$60/t	Probably applicable (need further test)
5	Soil washing	This technique is mainly used for treatment of the soil contaminated by high-concentration pollutants. In the Project, contaminated soil is mostly silty soil, which may affect the washing effect. Moreover, the washing wastewater should be further treated in accordance with relevant standard. Therefore, the soil washing technique is technologically infeasible in As-contaminated soil remediation of the Project.	Currently, the technique has been tested in pilot tests. It can be simply implemented and managed and the required equipment can be produced at home. Therefore, this technique is operable and can be applied in relevant projects.	1) In Chongqing, the soil is mainly comprised of red clay. Therefore, soil washing is not applicable; 2) due to long aging time of the As-contaminated soil, soil washing is of low-efficiency in Ganshui site; 3) the main pollutant in Ganshui site is BHC, which is a kind of hydrophobic organics. Thus, soil washing is not applicable; 4) as soil washing has not yet been applied in contaminated soil remediation in Chongqing, there is a lack of regulatory experience.	\$358~\$361/m^3	N/A

6	Vitrification	This technique is applicable to remediation of all kinds of contaminated soil, especially the soil contaminated by high-concentration pollutants. It is of good remediation effect and requires short time for remediation. Therefore, this technique is technologically applicable to soil remediation of the Project.	This technique has not yet been tested or applied in any pilot test or project. For the technique, there is insufficient auxiliary equipment and qualified engineering technicians. Furthermore, this technique needs complicated equipment which should be manufactured with sophisticated technologies. It is hard to develop and produce such equipment in a short term in China. Currently, this technique is not operable and cannot be applied in projects in China.	1) In Chongqing, or even in China, this technique has not yet been applied in projects and it may easily cause secondary environmental pollution; 2) there is a lack of experience in regulation of remediation; 3) vitrification requires high cost.	Public data of the cost of this technique is not yet available. But the heating temperature required by this technique in operation is about 1,800-2,200°C, requiring high energy consumption. It is preliminarily predicted that the cost of this technique is higher than that of the conventional thermal desorption technique.	N/A

It can be seen from Table 28 that incineration and phytoremediation are applicable to remediation of As-contaminated soil at Ganshui site. Specifically, the incineration technique is more mature and has been successfully applied in projects. Therefore, it can be directly used for the remediation of As-contaminated soil without further test. Phytoremediation technique also has been successfully applied in some projects or demonstration projects in China. But its effect is seriously affected by many factors, such as the physical and chemical properties of the soil and the concentration of pollutants. In order to reduce the application risks; therefore, it is required to conduct relevant feasibility tests, verify its technical feasibility and acquire relevant engineering parameters of the technique so as to facilitate the implementation of the projects and reduce the risks in project implementation.

5.6.1.5. Analysis on Screening Results of Remediation Techniques

Based upon the analysis on the applicability, operability, remediation cost and domestic management and operation level of the contaminated site remediation techniques commonly used at home and abroad, we preliminarily select the remediation techniques applicable to POPs-contaminated soil reference to the features of Ganshui site, and the management requirement both of Chongqing administration and site Owner, as shown in Table 29.

Table 29 Remediation Techniques Applicable to Ganshui Site

Contaminated media	Target pollutant	Need no further test	Need further test
Soil	α-BHC and β-BHC	Incineration	Anaerobic biodegradation
			Phytoremediation
	As	Incineration	Phytoremediation

The three alternatives, i.e., incineration, anaerobic biodegradation and phytoremediation, vary in the degree of application at home and abroad, depending upon the maturity of the techniques:

(1) From the overseas cases about remedying the soil contaminated by high-concentration BHCs through anaerobic biodegradation indicated in Table 30, it can be found that the removal rate of BHCs in the soil ranges from 58% to 98% within different remediation times. As for the soil contaminated by low-concentration BHCs, Zhao Yukun, et al.[9] (2011) discovered that the BHCs content in soil is reduced to 0.068 mg/kg from 5 mg/kg after 30 days' microbial degradation; Quintero et al. (2006)[10] found that the BHCs content in soil is reduced from 100 mg/kg to 0.2 mg/kg^{-1} after 206 days' anaerobic biodegradation.

Table 30 Remediation Cases of BHCs-Contaminated Soil by Anaerobic Biodegradation[11]

NO.	Site	Location	Time (d)	Remediation volume	Concentration before remediation (mg/kg)	Residual concentration in soil (mg/kg)
1	Gila River Indian Community (GRIC)					
	Module 1	Chandler, Arizona	272	3,500 cubic yards	59	4
	Module 2		272		31	4
	Module 3		272		29	2
	Module 4		272		211	3

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[9] Zhao Yukun, Liao Haifeng, Chen Yinan, et al. Research on Effects of Microbial Remediation for HCH/DDT-contaminated Soil [J]. Jiangsu Agricultural Sciences, 2011, 39(2): 463- 465.

[10] Quintero J.C., Moreira M.T., Lema J.M., et al. An anaerobic bioreactor allows the efficient degradation of HCH isomers in soil slurry[J]. Chemosphere, 2006, 63: 1005-1013

[11] Reference Guide to Non-combustion Technologies for Remediation of Persistent Organic Pollutants in Soil, Second Edition -2010, EPA 542-R-09-007

2	Navajo Vats					
	Laahty Family Dip Vat	Zuni Nation, New Mexico	31	253 cubic yard	29	4
	Henry O Dip Vat	Zuni Nation, New Mexico	68	660 cubic yards	23	8
	Nazlini		108	3.5 tons	291	71
	Whippoorwill		110	3.5 tons	40	17
	Blue Canyon Road		106		100	17
	Jeddito Island		76		22	3
	Ojo Caliente	Zuni Nation, New Mexico	14	200 cubic yards	14	4
	Poverty Tank		345		33	8
3	Gila River Boundary (GRB)					
	RRB (6 remediation modules)	Laveen, Arizona	180	8,000 cubic yards	23-110	5-20

(2) Widely applied in remediation of US Superfund sites, incineration is a technique that can be directly applied in projects, needing no further test. The overseas application cases of incineration technique are shown in Remediation case study-on site incineration (Volume 12, EPA542-R-98-016). Table 31 includes only the domestic cases of contaminated soil remediation by cement kiln technique.

Table 31 Domestic Application Cases of Incineration Technique

1. Cement Kiln Co-processing Project in Beijing	
Site	Beijing Hongshi Coating Plant, Beijing Dyestuffs Plant, Beijing Chemical Works
Treatment and disposal unit	Beijing Jinyu Mangrove Environmental Protection Technology Co., Ltd.
Quantity of disposed soil	● Contaminated soil from a former Beijing coating plant: 50,000t soil contaminated by organo-chlorine pesticides disposed through incineration; ● Contaminated soil from a former Beijing chemical plant: 58,183.9m^3 of contaminated soil containing olefin; 47,947m^3 of containing aldehyde and alcohol;
Target pollutant	Pesticides, PAHs, dyestuff, VOCs and heavy metals
Remediation effect	Pass the remediation validation and achieve the goal of remediation
2. Cement Kiln Co-processing Project in Chongqing	
Site	Chongqing Agricultural Chemicals Plant and Chongqing Tianyuan Chemical Plant
Treatment and disposal unit	Chongqing Lafarge Cement Plant
Quantity of disposed soil	● 30000 disposal tons of contaminated soil by persistent organic pollutants (pops), volatile and semi volatile organic compounds from Chongqing Dye Chemical Factory; ● 30000 disposal tons of contaminated soil by DDTs from the Pesticide Chemical industry (group) co., LTD; ● 1600 disposal tons of petroleum hydrocarbons contaminated soil from the 1.2 block of 9 Gao Road of Yuzhong district in Chongqing;
Target pollutant	Pesticides, PAHs, VOCs, SVOCs and petroleum hydrocarbons
Remediation effect	Pass the remediation validation and achieve the goal of remediation
3. Co-disposal project in Shanghai Cement Kilns	
Site	Heshan POPs-contaminated site in Hanyang District of Wuhan
Treatment and disposal unit	Shanghai Huaxin Environmental Engineering Co., Ltd.

Quantity of disposed soil	● Shanghai Huaxin Environmental Engineering is one of the model enterprises of Sino-Germany Waste Pesticide Management Project. It disposes of a large quantity of high-toxicity waste pesticides (such as tetramine and DDT) and their packages collected by relevant department of Hubei Province through cement kiln. ● Main pollutants at Heshan contaminated site in Hanyang District of Wuhan include BHCs and DDTs with the maximum concentrations of 33,548.137 mg/kg and 4,661.463 mg/kg respectively. Apart from them, there are also organic phosphorous insecticides and pyrethroid pesticides. The pollution depth is 1.8m on average and 9m at maximum. By June 2013, the total quantity of the contaminated soil disposed had reached 300,000t.
Target pollutant	Organophosphorus pesticides and organochlorine pesticides
Remediation effect	Pass the remediation validation and achieve the goal of remediation

(3) Cases of phytoremediation: Chen Tongbin research team from China Academy of Sciences established China’s first demonstration project of As-contaminated soil remediation with ciliate desert-grass in Chenzhou of Hunan. In 2005, they planted 1280 mu (1mu≈ 666.67 m^2) of ciliate desert-grass in Guangxi Huanjiang Maonan Autonomous County to remedy As-contaminated soil; in 2007, they planted 500 mu of ciliate desert-grass in Gejiu of Yunnan for remediation of As-contaminated soil. In 2012, the Ministry of Finance and the Ministry of Agriculture jointly issued the *Implementation Plan on Prevention and Control of Heavy Metal Pollution in the Farmland of Agricultural Products,* which designates the 5,000mu heavy pollution remediation area in Chenzhou and 4000 mu non-product area in Xiangtan as demonstration pilot projects of phytoremediation. Zhang Chaolan[12] disposed the BHCs-contaminated soil with ryegrass and alfalfa respectively. After 3 months, the BHC content in soil was reduced from 1090 µg/kg to 374 µg/kg and 399 µg/kg, respectively. In addition, Zhao Xu[13] and Jia Qingzhu[14], et al. discovers that BHCs anaerobic degradation conforms to the first-order kinetic equation. Meng Fanli[15] finds that electron donor can greatly shorten the anaerobic degradation time of BHC.

From the above cases, conclusions were drawn that:

- The incineration technique has been widely applied in contaminated soil remediation in China. With regard to incineration, there are sufficient disposal sites and engineering supervision experience in Chongqing;
- Phytoremediation of As-contaminated soil has been widely tested and promoted in China and phytoremediation of BHCs-contaminated soil has also been tested in the greenhouse;
- Anaerobic biodegradation of BHC-contaminated soil has been successfully applied in relevant projects at abroad; but in China, lab study on anaerobic biodegradation of BHC-contaminated soil has just been completed;
- In China, lab study on anaerobic biodegradation of BHCs has been completed; therefore, it is time to conduct small-scale test to acquire engineering application parameters.

In consideration of the time requirements of Ganshui site remediation and the features of pilot projects (it is required to adopt creative remediation technique and meanwhile, meet the standards related to contaminated soil remediation), the application of anaerobic biodegradation and phytoremediation are encouraged for Ganshui site remediation, and the alternative of cement kiln incineration is prepared in case of the failure of anaerobic biodegradation and phytoremediation.

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[12] Zhao Chaolan, Wang Xiaoyong, Jiang Wen, et al. Research on Phytoremediation of Soil Contaminated by Organo-chlorine Pesticides [J]. Ecology and Environmental Sciences, 2007, 16(5): 1436- 1440.

[13] Zhao Xu, Quan Xie, Zhao Huimin, et al. Effects of Organic Matters and Metal Hydrous Oxides in Sediment on the Anoxic Biodegradability of γ-666 and p,p'- DDT [J]. Environmental Sciences, 2002, 23:115-118.

[14] Jia Qingzhu, Quan Xie, Chen Shuo, et al. Anoxic Degradation Kinetics of Gamma-HCH in Sediments of Liaohe River [J]. Environment Sciences, 2000, 21: 44-47.

[15] Meng Fanli. Research on Anaerobic Biodegradation Technology of HCH [M]. Shandong University, 2012.

5.6.2. Selection of Remediation Demonstration Site

The contaminated soil of Ganshui site mainly contains α-BHC, β-BHC and As. With respect to the ex-situ disposal of the contaminated soil, it is required to first consider the existing disposal sites where anaerobic biodegradation, phytoremediation and incineration can be implemented. In general, the demonstration sites should meet the requirements stated in Table 32:

Table 32 Selection Requirement of Remediation Demonstration Site

NO.	Specific requirement	Lafarge Cement Plant
1	Have the qualifications, equipment, technologies and management experience necessary for anaerobic biodegradation, phytoremediation and incineration of contaminated soil.	Compliant
2	Have ever implemented contaminated soil remediation projects	Compliant
3	Have necessary area for remediation demonstration: phytoremediation and anaerobic biodegradation of As-contaminated soil need at least an area of 200 m^2 and 300 m^2 respectively. According to the required ratio (1:1) between the functional zone area and auxiliary zone area (drainage channels, mechanical operation passageways and auxiliary facilities), it is conservatively estimated that the whole demonstration area needs an area of 1,000 m^2.	Compliant
4	Be far away from environmental sensitive areas (such as forests, grasslands, rivers and wetlands), urban industrial and agricultural development planning areas, social protection areas (national parks, natural reserves, scenic spots and world heritage sites), ecological preservation areas, domestic drinking water conservation areas, important military zones, national closed security zones and any other areas that should be specially protected;	Compliant
5	Keep a safety distance from populated areas, such as hospitals, plants, schools, government departments and residential quarters, according to EIA requirements;	Compliant
6	Keep a safety distance from polluting enterprises, such as mining, smelting, petrochemical industry and pesticide production enterprises, according to EIA requirements;	Incompliant
7	Keep a safety distance from warehouses of dangerous goods (such as explosives and inflammables), facilities that may generate numerous smoke or electromagnetic interference and protection range of high voltage transmission lines, according to EIA requirements.	Compliant
8	Be located in the downwind direction of the prevailing wind of nearby residential areas and far away from flood control regions.	Compliant
9	Build the demonstration site in the area preferable in terms of topography, terrain and geological conditions, utilize wastelands, badlands and the lands requiring less demolition as far as possible and take consideration into transportation and water and power supply.	Compliant
10	Investigate the hydrogeological conditions before site selection. The demonstration site should be situated in an area of stable geological structure with a seismic intensity less than 7 magnitudes and far from the regions of karst caves or any other areas susceptible to serious natural disasters, e.g., flood, landslide, debris flow and tide. Furthermore, the bottom of the demonstration site should be higher than the highest surface water level.	Compliant
11	Pass the environmental impact assessment.	Compliant
12	Whether it is allowed to dispose of POPs-contaminated soil.	Compliant
13	Whether available space in the contaminated soil storage site is large enough and the period for contaminated soil co-processing in cement kiln is suitable.	Compliant

Based upon the conditions above, Chongqing PMU preliminarily designates Lafarge Cement Plant as the demonstration site for the soil remediation. However, due to incompliance with requirement (3), it is required to evaluate the effect of the production in Lafarge Cement Plant on contaminated soil remediation (which will be analyzed in the section of “Environmental Management Plan”).

5.6.3. Scheme (I) for Ganshui Site Remediation

5.6.3.1. Soil Screening

The soil of Ganshui site mainly consists of clay and gravel. Therefore, soil screening is a necessary pretreatment process before phytoremediation, anaerobic microbial degradation and cement kiln co-processing. The target of soil screening is to acquire contaminated soil with the particle diameter lower than 50 mm. In view of less contaminated soil at Ganshui Site, it is decided to perform screening manually:

- Primary screening: separate the contaminated soil from other mixtures (such as rebars, wood blocks and plastics), sort out the stones with the diameter higher than 500 mm, manually wash away the soil on the stones and then transfer the stones to the net stone storage yard for shipping.
- Secondary screening: conduct secondary screening for the preliminarily screened soil, sort out the stones with the diameter ranging from 50 mm to 200 mm, wash the stones and then transfer them to the net stone storage yard for shipping.

After screening, the contaminated soil with the particle diameter lower than 50 mm will be further treated and disposed.

5.6.3.2. Pilot Test of Anaerobic Biodegradation

(1) Construction of anaerobic biodegradation tank

At the stage of small-scale test, it is planned to construct 4 cement anaerobic degradation tanks which are 2 m long, 2 m wide and 1.6 m deep (as shown in Figure 26). On the right edge of the tanks, two samplers will be mounted and in the middle of the tanks, one submersible mixer will be provided (power of 4 kW; impeller diameter of 0.4 m; impeller speed of 960 r/min). Around the tanks, protective fences and warning signs will be set and drainage ditches will be constructed. Meanwhile, the tanks will be covered with anti-seepage films or wood boards to prevent dust of the cement plant from falling into the tanks.

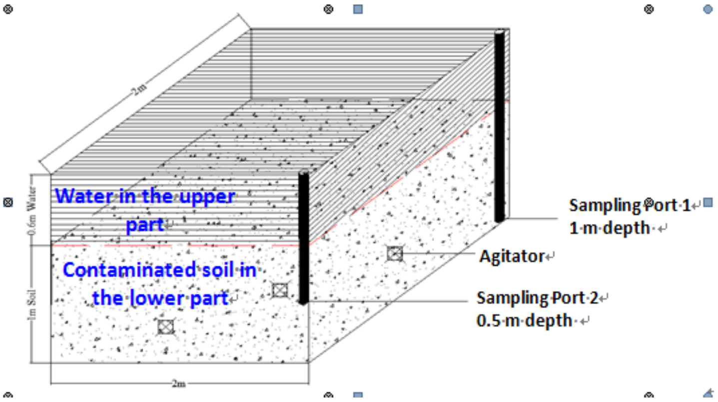


Figure 26 Schematic of Anaerobic Degradation Tanks

(2) Demonstration projects of anaerobic biodegradation of contaminated soil

According to domestic and overseas references related to anaerobic biodegradation of BHCS-contaminated soil, the results of the lab pre-research conducted by Beijing Municipal Research Institute of Environmental Protection and the properties of the contaminated soil at Ganshui site, the technical parameters for field small-scale test are designed, as shown in Table 33.

Table 33 Technical Parameters of Anaerobic Biodegradation of Contaminated Soil

Anaerobic pool	Blood powder	Industrial waste acid	Iron powder	Duration of enhanced iron powder degradation	Duration of anaerobic biodegradation
1	6 g/L	0 g/L	0 g/kg	0 day	0 - 140 days

2	6 g/L	0 g/L	20 g/kg	0 -10 days	10- 150 days
3	0 g/L	8 g/L	20 g/kg	0 -10 days	10- 150 days
4	0 g/L	8 g/L	0 g/kg	0 day	0 - 140 days

- Air-dry the soil as per the water-soil ratio of 1:1, screen the soil twice with a 1 mm screen and then put the soil into the anaerobic tanks;
- Add dried blood and industrial waste acid (acetic acid solution) prepared as per the table and create an anaerobic environment by flood out;
- Further degrade residual BHCs in No. 2 and No. 3 tanks through an anaerobic way according to Table 33, after 10 days from the day on which iron powder is added;
- Stir the iron powder and soil with a mixer for full mixing. The rotation speed of the mixer can be set as 960 r/min.

(3) Estimated quantity of disposed soil and estimated degradation time

As each anaerobic biodegradation tank can dispose of about 4.5 m^3 of contaminated soil and four anaerobic tanks will be built for the each batch with about 18 m^3 of contaminated soils. In general, each pilot test of anaerobic biodegradation requires 150 days.

(4) Sample collection and preservation

Samples should be collected for testing every 70 days during anaerobic biodegradation and every 10 days during enhanced iron powder degradation. In order to reduce the experimental error, it is recommended to collect 1 soil composite sample at the depth of 0.5 m and 1.0 m respectively in each anaerobic tank. As there are 4 anaerobic tanks at the stage of small-scale test, 24 soil samples should be collected for each batch of anaerobic biodegradation.

(5) Sample testing

The soil collected should be tested within 14 days after collection. The test items include α-BHC, β-BHC and As and the test method should be subject to HJ 350-2007 Appendix G.

(6) Recycling of contaminated soil after anaerobic biodegradation

After anaerobic biodegradation, the contaminated soil should be further disposed through phytoremediation, with the water solution in the upper part as irrigation water.

5.6.3.3. Pilot Test for Phytoremediation

(1) Infrastructure of phytoremediation test site

As the test site for contaminated soil remediation of Ganshui Site, Lafarge Cement Plant has the following facilities: in-plant transportation roads that allow the access of trucks and excavators, irrigation well, agricultural mechanical equipment warehouse, fertilizer and seed warehouse, phytoremediation harvest warehouse and greenhouse (including seedling nursing stand, seedling nursing box, peat soil and temperature & humidity control system, etc.).

Around the phytoremediation site, it is required to build a protective fence and set warning signs indicating the purpose of the plants, so as to prevent livestock from eating the plants by mistake.

(2) Field pretreatment of contaminated soil

Mix the contaminated soil and the activated sludge from the domestic wastewater treatment plant with an excavator at the mass ratio of 5:1, lay the mixture over the ground with the thickness of 20-30 cm and then air-dry the mixture for 7 days. In general, the planting area is about 200 m^2 which was divided into four parallels.

(3) Remedying plant seedling nursing

In consideration of the soil properties and climatic features in Chongqing and the applicability for remediation of As- and BHC-contaminated soil, ryegrass, alfalfa, ciliate desert-grass and pteris nervosa are selected as the remedying plants for the contaminated soil at Ganshui Site. Among them, ciliate desert-grass is reproduced by spores and pteris nervosa, alfalfa and ryegrass are reproduced by seeds.

Culture substrate: substrate refers to the material where the plants (such as nursery stock) will root. It plays an equal role as earth in field production. In general, substrate should be the loose and permeable soil with the grain size not higher than 4mm. The soil in vegetable gardens or seriously contaminated soil should not be adopted. Furthermore, the substrate should be free from pathogenic bacteria, worm egg and weed seed. For the substrate, the pH value should be 7.0-8.0, exchangeable calcium content should be1.6-2.0 g/kg and the total nitrogen and total phosphorus contents should be 0.5-1.0 g/kg and 0.4-1.0 g/kg respectively.

Seedling nursing of ciliate desert-grass: transfer spores to the culture medium with various vessels (such as seedling bag, tray and vessels of different specifications) to protect the roots from being damaged in transplanting. This method can achieve high transplanting survival rate, prevent the effects of season and facilitate transportation. Seedling nursing process: sow the spores to the culture substrate, transplant them to the wet sterilized culture medium when they grow to 2cm and then transplant seedlings to the field, together with the culture substrate when they grows to 6cm.

Seedling nursing of ryegrass, alfalfa and pteris nervosa: sow the seeds directly to the wet sterilized culture substrate and then transplant them to the field, together with the culture substrate when they sprout and grow to 8-10 cm.

(4) Demonstration of phytoremediation:

Intercropping: plant ciliate desert-grass with the line spacing of 1.5m; interplant 2 lines of alfalfa between each 2 lines of ciliate desert-grass, with the line spacing between ciliate desert-grass and alfalfa of 50 cm; plant pteris nervosa among alfalfa plants with the line spacing of 10 cm; plant ryegrass between alfalfa and ciliate desert-grass with the line spacing of 10cm.

Apply N, P, K or Ca fertilizers every 2-3 months according to the soil and fertilizer test results after 2 months from planting. The concentration of the fertilizers should be as follows: N fertilizer: 0.05 mol/L; P fertilizer: 0.02 mol/L; Ca fertilizer: 0.0l mol/L; and K fertilizer: 0.0l mol/L.

Inoculate AM fungus (purchased from Mycorrhiza Center of Chinese Academy of Forestry) after 3 months from planting (the mass ratio of AM fungus and contaminated soil should be 1:200).

Water the plants every 3-4 days to maintain the soil humidity of 20-30%.

(5) Sample collection and test

Collection of soil samples: for phytoremediation, the soil sampling density is 10 samples/ 100m^2; the estimated laying area of contaminated soil is 200 m^2; the sampling frequency is once every 6 months and the remediation period is 1.5 years. In sampling, diagonal locations are adopted and the total quantity of soil samples is estimated to be 60.

Soil samples are mainly collected from the soil with the plant roots of 2-3 cm: root up the plants, remove the soil from the roots, screen the soil with a 20 mm screen to eliminate the plant roots and stones, collect the soil with a wide-mouth glass bottle and then put the bottle into a 4°C sample box (filled with blue ice in advance). After that, fill in the sample transfer voucher according to the contaminated site sampling requirements.

Collection of plant samples: dry and grind the samples after washing and then preserve them in sealed brown glass bottles. In general, 3 samples should be collected for each kind of plant (totally 4 kinds). The sampling frequency is once every 6 months; the remediation period is 1.5 years; and the total quantity of plant samples is estimated to be 48.

Test items of soil and plant samples: α-BHC, β-BHC and As.

(6) Estimated quantity of disposed soil and estimated disposal time

Phytoremediation is applicable to As-contaminated soil. It may not be affected by the quantity of contaminated soil as long as there is sufficient remediation space. Therefore, all As-contaminated soil (31.4 m^3) can be disposed at a time during small-scale test. Generally, the time for phytoremediation should not be less than 450 days, including the time for infrastructure building at early stage, seedling nursing and plant growth.

(7) Management of plants

Ciliate desert-grass and pteris nervosa are hyperaccumulators of As. After phytoremediation; therefore, all ciliate desert-grass and pteris nervosa can be used as biomass energy materials for power generation. After high-temperature incineration, the fly ash can be disposed with solidification/stabilization technique.

5.6.3.4. Wastewater Treatment

Anaerobic biodegradation and phytoremediation of contaminated soil may generate wastewater containing BHC and As. Therefore, the demonstration site should be provided with a wastewater treatment unit. The potential wastewater sources are as follows:

- After soil screening, it is required to wash large-diameter stones to remove the contaminated soil on the surface. The washing wastewater should be treated;
- During construction at the demonstration site, contaminated soil may adhere to the machinery equipment and tools. Therefore, the equipment and tools should be washed after construction. The washing wastewater generated by them should be treated;
- Due to rain leaching, the soil may produce water containing BHC and As, which should be collected and treated;
- After anaerobic biodegradation of contaminated soil, wastewater containing BHC and As may be produced, which should be collected and treated.

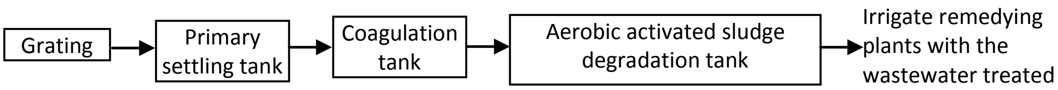


Figure 27 Wastewater Treatment Process

The wastewater treatment process is shown in Figure 27. Main functions of each step are as follows:

- The grating is mainly used to intercept plant residues, waste plastic bags and other solid wastes;
- The primary settling tank is mainly used for phytoremediation of the soil and sediments collected;
- The coagulation tank mainly precipitates As in the wastewater by virtue of coagulant (take ferric trichloride as an example). After that, the sediments in the tank should be collected for phytoremediation;
- The aerobic activated sludge degradation tank mainly degrades low-concentration BHC pollutants in the wastewater;
- After treatment, the wastewater is used to irrigate the phytoremediation area, other than being discharged.

5.6.3.5. Implementation of anaerobic biodegradation and phytoremediation projects

As for phytoremediation, As-contaminated soil can be completely treated at the stage of small-scale test. Therefore, there is no need to otherwise implement phytoremediation project.

If the small-scale test of anaerobic biodegradation can successfully make the α-BHC and β-BHC contents in the contaminated soil meet the target values, remediation can be implemented for all contaminated soil based upon the test parameters acquired in the small-scale test. For this, it is required to build 16 anaerobic tanks. The remediation time is estimated to be 400 days. The allocated quantity of contaminated soil to be treated by anaerobic biodegradation is shown in Table 34.

Table 34 Soil Allocation of Scheme (I)

NO.	Name	Soil type	Quantity of disposed soil	Estimated time	Remarks
1	Anaerobic biodegradation	Soil Mildly contaminated by α-BHC and β-BHC	There are 4 anaerobic tanks to be built, and each tank can dispose of 4.5 m^3 of contaminated soil at a time, therefore, if there are 16 anaerobic tanks, the total volume of contaminated soils will be 64 m^3 for each batch, and the contaminated soil of Ganshui Site will require two bathes to complete remediation.	Each pilot test needs 150 days, and the total time for anaerobic biodegradation was about 400 days.	After anaerobic biodegradation, it is expected to meet the remediation targets related to α-BHC and β-BHC.
2	Phytoremediation	Soil moderately contaminated by As and soil mildly contaminated by α-BHC and β-BHC	Dispose of 31.4 m^3 of contaminated soil during the small-scale test	Phytoremediation period: 500 days	After phytoremediation, it is expected to meet the remediation targets related to α-BHC, β-BHC and As.

5.6.4. Scheme (II) for the Remediation of Ganshui Site Contaminated Soil

If anaerobic biodegradation and phytoremediation cannot make the α-BHC and β-BHC contents in the contaminated soil meet the target values, it is recommended to implement Scheme (II): co-processing in cement kiln. In this scheme, all contaminated soil should be transported to Lafarge Cement Plant.

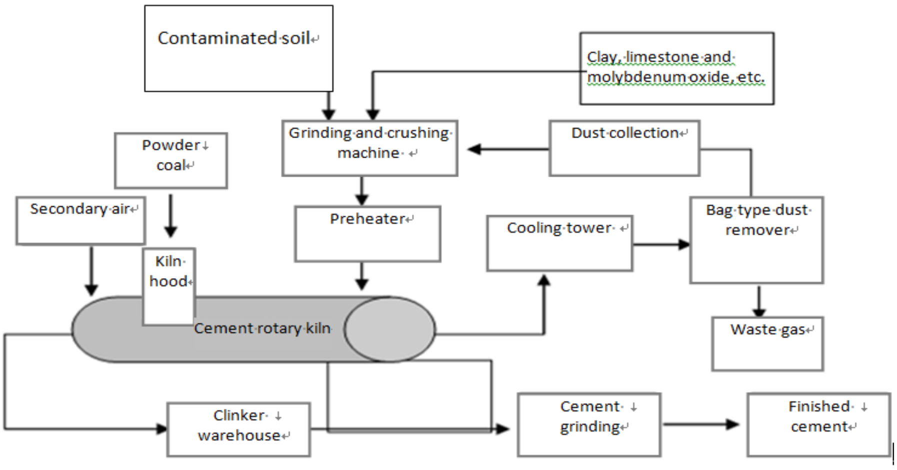


Figure 28 Technological Process of Contaminated Soil Co-processing in Cement Kiln

The process of contaminated soil co-processing in cement kiln is shown in Figure 28. Details of the process are as follows:

- Transfer BHCs-contaminated soil from the storage site to the grinding and crushing workshop with specialized transportation equipment. The feeding rate of the contaminated soil should be 1.6%-3.0% and the feeding rate of such raw materials as clay, limestone and molybdenum oxide should be determined based upon the type of cement. Besides, the materials should be transported with sealed vehicles.

- After mixing, convey the mixture of contaminated soil and cement raw materials into the grinding and crushing machine, which is an automated mechanical process in sealed state.
- Feed contaminated soil from the high-temperature section of the cement kiln. In this section, the temperature of gas and materials is up to 900°C, thus pollutants can be completely degraded and decomposed. According to the above principles, it is planned to feed BHCs-contaminated soil from the flue gas chamber of the cement kiln. Therefore, the flue gas chamber should be provided with feeding pipes and lifting devices.
- Parameters of the rotary cement kiln and the resident time of materials are shown in Table 35.

Table 35 Parameters of Contaminated Soil Co-processing in Cement Kiln

Characteristic	Temperature and residence time
Temperature of the cement kiln	Material temperature >1450°C Flame temperature >1800 °C
Resident time in the cement kiln	>12-15s at the temperature >1,200°C >5-6s at the temperature >1,800°C
Temperature of the preheating furnace	material temperature >850 °C Flame temperature >1000°C
Resident time in the preheating furnace	>2-6s at the temperature >800°C

- Flue gas cooling in cement kiln

As for the scheme of co-processing in cement kiln, effective control of dioxin is a key technical link. The exhaust gas treatment system involved in this scheme consists of quenching equipment, bag-type dust remover and acid gas washing tower, etc. Equipped with rows of nozzles, the quenching equipment can rapidly cool the high-temperature flue gas below 200°C through high-temperature cold water injection. In this way, we can avoid the temperature of 200-500°C, at which dioxin may be generated most easily and consequently prevent the generation of dioxin effectively.

- Dust removal in cement kiln

In the technical scheme of co-processing in cement kiln, bag-type dust removal technology is adopted. With this technology, the dust removal efficiency can be remained at 99.8%-99.99% and the emission concentration can be controlled below 30 mg/Nm^3, which meets the emission standard. Meanwhile, the dust collected can be recycled as raw material.

- Technical feasibility and environmental compliance of contaminated soil incineration of Lafarge Cement Plant

Incineration of contaminated soil is a remediation technique needing not test. For the Project of Contaminated Soil Co-processing in Cement Kiln of Lafarge Cement Plant, feasibility study and environmental impact assessment have been conducted. Besides, the contaminated soil feeding system, soil storage system and 3-electric field dust removal facility in the kiln hood have been technologically transformed (employ two-chamber four-field dust removal facility, replace the voltage stabilizer and increase flue gas spray cooling device). After the technological transformation, the cement kiln can dispose of 70 t contaminated soil every day. In the Approval of Environmental Protection Final Validation of Chongqing Construction Projects [Yu (Shi) Huan Yan [2011] No. 109], it is indicated that: the environmental protection facilities, environmental risk prevention measures and emission of pollutants comply with our approval requirements. Therefore, we approve the environmental protection final validation of the Project.

(I) EIA results of the technological transformation for the contaminated soil incineration technique of Lafarge Cement Plant are as follows:

The maximum emission concentrations of the pollutants in organized emission of the exhaust gas from the kiln tail are as follows: PM: 36.7 mg/m^3; sulfur dioxide: 78 mg/m^3; nitrogen oxide: 1.23×10^2 mg/m^3; hydrogen chloride: 0.584 mg/m^3; dioxin: 0.016 ngTEQ/Nm^3, which conform to the requirements on standard emission limits of “newly-built production lines” provided in the *Emission Standard of Air Pollutants for Cement Industry* (GB4915-2004). The average dust removal efficiency of the bag-type dust remover in the kiln tail is 99.9%. In addition, the maximum emission concentration of As, Ni and their compounds (calculated as As + Ni) in the exhaust gas from the kiln tail is 2.06×10^{-2} mg/m^3 and that of Cr, Sn, Sb, Cu, Mn and their compounds (calculated as Cr + Sn + Sb + Cu + Mn) is 5.84×10^{-2} mg/m^3. Apart from these substances, Hg, Pb, Cd and their compounds have not been detected in the exhaust gas. It can be seen that the Project complies with the emission limits specified in the *Approval of EIA Report of Chongqing Construction Projects* [Yu (Shi) Huan Yan (2009) No. 224] and the *Pollution Control Standard for Hazardous Wastes Incineration* (GB18484-2001).

The maximum emission concentrations of the pollutants in organized emission of the exhaust gas from the kiln hood are as follows: PM: 28.4 mg/m^3; sulfur dioxide: 48.6 mg/m^3, which conform to the requirements on standard emission limits of “newly-built production lines” provided in the *Emission Standard of Air Pollutants for Cement Industry* (GB4915-2004). The average dust removal efficiency of the bag-type dust remover in the kiln hood is 99.8%.

The maximum emission concentrations of the pollutants in unorganized emission of exhaust gas are as follows: PM of 0.183 mg/m^3; NMHC of 0.663 mg/m^3; HCl of 4.72×10^{-2} mg/m^3, which conform to the unorganized emission limits provided in the *Integrated Emission Standard of Air Pollutants* (GB16297-1996).

For periodic measurements, a frequency of once a month and up to once a year at the time of normal operating conditions is given as an indication.

(II) The results of daily monitoring for the contaminated soil incineration technique of Lafarge Cement Plant are as follows:

During July-August 2013, Chongqing Environment Monitoring Center monitored the emission of Chongqing Lafarge Cement Plant. The monitoring involves organized air pollutant emission of bag-type dust removers of the cement kiln and unorganized air pollutant emission of the storage site, and the test indicators include total Hg, Cu, As, Pb and Cr contents and dioxin content. During this period, Chongqing Lafarge Cement Plant disposed of the high-risk contaminated soil from Chongqing Agricultural Chemicals Plant by incineration. The main pollutant in the contaminated soil is BHC. In the soil, the total Cu content is 4.99×10^{-3} mg/m^3, total Cr content 4.31×10^{-2} mg/m^3, total As content 2.66×10^{-4} mg/m^3, total Hg content 8.14×10^{-3} mg/m^3, content Pb content 9.51×10^{-4} mg/m^3 and dioxin content 0.0062 ngTEQ/Nm^3. All the indicators conform to the *Emission Standard of Air Pollutants for Cement Industry* (GB4915-2004).

In summary, the contaminated soil incineration technique of Lafarge Cement Plant can meet the needs for co-processing of the contaminated soil of Ganshui Site in the cement kiln in terms of technical feasibility and environmental compliance.

5.6.5. Diverting Rules of Alternative Treatments

The diverting rules of two schemes have been developed as follows:

In scheme 1, for the pilot test of anaerobic biodegradation, firstly, select the optimal treatment with highest BHC removal from the four parallels, and then repeated the optimal operation parameters with four anaerobic tanks, and the phytoremediation test was synchronously conducted with four parallels. If the remediation efficiency of more than 3/4 parallels of anaerobic biodegradation and phytoremediation meet the remediation target values, it will be proposed that the two technologies of anaerobic biodegradation and phytoremediation are adaptive for Ganshui site; In addition, the remediation time of anaerobic biodegradation and phytoremediation can be lengthened for not more than 7 months to get the remediation targets.

If more than 3/4 parallels of the pilot test cannot meet with the target values, the test results will be evaluated and reviewed by expert appraisals held by Chongqing PMU, the criterion to make a diverting decision for scheme 2 mainly includes the remediation target, and the factors of remediation time (not more than 2 years), remediation cost (not more than 3 times of the incineration cost) were supplementary.

The final decision whether to divert remediation scheme to cement kiln incineration will be approved by GEF and FECO.

5.6.6. Disposal of Up-to-Standard Soil after Remediation

Disposal of the soil remedied by Scheme (I): the risk of the soil can reach the allowable level after phytoremediation and anaerobic biodegradation. But it is conservatively recommended to limit the recycling of the remedied soil. In generally, the soil can be used for building roads, backfilling the foundation pits of non-sensitive areas, covering landfills, landscape planting or for the raw materials of co-incineration in cement kiln, rather than being used in sensitive areas, such as farmlands, water source protection areas and ecological preservation areas.

Disposal of the soil remedied by Scheme (II): the contaminated soil is completely destroyed through incineration in the cement kiln. Therefore, this scheme does not involve recycling of remedied soil.

5.6.7. Investment Estimation of Ganshui Site Remediation

5.6.7.1. Investment estimation of Scheme (I)

According to the local economic level and market price in Chongqing, the investments of Ganshui Site Remediation Subproject Scheme (I) are estimated to be RMB 1,355,400, which can be divided into two parts: expenses for excavation and transportation of contaminated soil and expenses for small-scale test and project implementation of anaerobic biodegradation and phytoremediation, but excluding the construction expenses of auxiliary facilities of the demonstration site (such as construction of seedling nursing greenhouse, drainage ditches, surrounding fences, access roads and power and water supply pipelines). Details of the expenses are shown in Tables 36 and 37:

Table 36 Estimated Expenses of Excavation Work of Ganshui Site

NO.	Item	Unit price	Specification	Amount (RMB 10,000)	Remarks
1	Transport vehicle	1,200 yuan/time	8t/ 50 times	6.0	• Transportation of contaminated soil and construction wastes. • Transportation of excavation equipment
2	Erection and removal of scaffolds	----	-------	4.0	• Labor cost for erection and removal of scaffolds • Material cost for erection and removal of scaffolds • Machinery cost for erection and removal of scaffolds
3	Labor cost for excavation	150 yuan/man-day	10 men/10 days	1.5	• Structure reinforcement and protection of houses • Water injection for and peeling of the wall surface of the pesticide storage room • Excavation, packaging and screening of contaminated soil, stone washing, backfilling and cleaning of transport vehicles • Seedling nursing, transplantation, planting, watering and fertilization during phytoremediation
4	Material cost	1.2 yuan/piece	Packaging bags (with the capacity of 20kg)/ 10,000 pieces	1.2	Packaging of contaminated soil (leakproof sealing bags)

5	Temporary storage fee of contaminated soil	500 yuan/ year-m^2	150.7 m^2/ 2 years	10.2	Storage fee of contaminated soil paid to Lafarge
6	Temporary settlement fees	-----	400 yuan/ man-month The rent for one-room and one-hall suite (housing area of 60m^2 or so) in Qijiang County is about 800 yuan/month.	0.64	Rents and living allowances for 4 months
Subtotal: RMB 235,400					

Table 37 Pilot Expenses of Anaerobic Biodegradation and Phytoremediation

NO.	Item	Unit price	Quantity	Amount (RMB 10,000)	Remarks
1	Construction of anaerobic biodegradation tank	1,000 yuan/tank	16	1.6	For anaerobic biodegradation
2	Waste acetic acid for anaerobic biodegradation	3,500 yuan/ ton	2 tons	0.7	Materials for anaerobic biodegradation
3	Dried blood for anaerobic biodegradation	5,000 yuan/ ton	2 tons	1.0	
4	Iron powder for anaerobic biodegradation	4500 yuan/ ton	4 tons	1.8	
5	Submersible mixer	3,000 yuan/piece	16	4.8	For stirring the soil in anaerobic biodegradation
6	Culture substrate	1,000 yuan/ ton	2 tons	0.2	For seedling nursing in phytoremediation
7	Plant grower	100 yuan	100	1.0	
8	Lease of excavator	1,500 yuan/set-day	60 sets-days	9.0	For stirring and laying the contaminated soil in phytoremediation
9	Expenses of ryegrass, alfalfa, ciliate desert-grass and pteris nervosa seeds	5,000 yuan/kg	1kg	0.5	For seedling nursing in phytoremediation
10	AM fungus	30,000 yuan/ ton	0.2 ton	0.6	Auxiliary material for phytoremediation
11	Activated sludge	800 yuan/ ton	5 tons	0.4	Auxiliary material for phytoremediation
12	Sample test fees	1,200 yuan/sample	300	36.0	Testing BHC and As
13	Labor cost	150 yuan/man-day	400 man-days	6.0	Labor costs in the remediation process
14	Supervision and validation expenses		2 items	20.0	Engineering supervision and validation fees refer to “Engineering Construction Supervision Fees” (National Development and Reform Commission [2007] no. 670) municipal construction of level III; Each fee of Environmental supervision and validation will be determined by the negotiation of owner and contractors, but not exceed 5% of total remediation

					expense
15	Land rent	1,500 yuan/mu-year	2 mu x 2 years	0.6	Leasing lands for remediation demonstration site of Lafarge Cement Plant
16	Water and electricity bills	Subject to the standard of Chongqing		1.0	Power and water supply of the remediation project
17	Report preparation cost	80,000 yuan/item	2	16.0	• Prepare the technical scheme for treatment of Ganshui Site • Develop the construction organization design of Ganshui Site
18	Taxes	-------	1 item	6.8	At the tax rate of 5%
19	Unpredictable expenses	------	------	4.0	
Subtotal RMB 1,120,000					
Total: RMB 1,355,400					

5.6.7.2. Investment Estimation of Scheme (II)

According to the local economic level and market price in Chongqing, the investments of Ganshui Site Remediation Subproject Scheme (II) are estimated to be RMB 753,400, as shown in Table 38.

Table 38 Estimated Expenses of Contaminated Soil Co-processing in Cement Kiln

NO.	Item	Work content	Specification/ quantity	Unit price	Expense (RMB 10,000)
1	Cost for co-processing in cement kiln	Contaminated soil co-processing in the cement kiln	150.7 m^3	1,200 yuan/ m^3	18.1
2	Report preparation cost	Report of contaminated soil co-processing in the cement kiln	1	100,000 yuan	10
3	Expenses for excavation and transportation of the contaminated soil of Ganshui Site are the same as Scheme (I)				22.9
4	Expenses for remediation supervision and validation of Ganshui Site are the same as Scheme (I)				20
5	Temporary settlement fees	Rents and living allowances	-----	----	0.64
6	Taxes	At the tax rate of 5%	1 item	----	3.7
Subtotal: RMB 753,400					

5.6.7.3. Project Financing

The funds of Ganshui site remediation subproject are mainly from two sources: 1) grants of the World Bank; 2) local supporting funds appropriated by Chongqing Government. The grants of the World Bank are mainly used to pay: i) monitoring costs during remediation (mainly for sample analysis in remediation technique demonstration); ii) service charges for environmental protection supervision and validation; iii) temporary settlement fees. Other expenses (including the expenses for excavation of contaminated soil, anaerobic biodegradation & phytoremediation and co-processing in the cement kiln and the taxes) are sourced from the local supporting funds appropriated by Chongqing Government.

5.6.8. Schedule of Ganshui Site Remediation Subproject

Table 39 Time Schedule for Remediation Subproject of Ganshui Site

No.	Name		Work contents	Time	Starting and ending time
1	Remediation Subproject tendering and bidding		● Remediation Project tendering and bidding ● Supervision of bidding ● Validation check of bidding	40 days	According to Scheme I, the remediation of Ganshui Site starts from EA review of World Bank and after the approved project is carried out, and it ends till the remediation subproject of Ganshui Site is completed with an estimated duration of no less than 500 days.
2	Structural reinforcement of Ganshui warehouses to store pesticides		● Housing structural reinforcement	3 days	
3	Cleanup and excavation of contaminated soil of Ganshui Site		● Cleanup and Excavation of Contaminated Soil ● Package of Contaminated Soil ● Validation for excavation pits ● Backfills of excavation pits	10 days	
4	construction of remediation demonstration site		● Remediation Demonstration Site Selection ● EIA and approval of remediation demonstration sites ● construction of remediation demonstration site		
5	Remediation Scheme I	Anaerobic microbial degradation	● Excavation of anaerobic degradation pools	3 days	
			● Cement cultivating of anaerobic degradation pools	7 days	
			● Contaminated soil screening and polluted large stones cleaning	5 days	
			● Construction and operation commissioning of waste water treatment units	30 days	
			● Small-scale anaerobic treatment of contaminated soil	150 days	
			● Implementation phase of contaminated soil anaerobic project	400 days	According to Scheme II, the remediation of Ganshui Site starts from EA review of World Bank and after the approved project is carried out, and it ends till the remediation subproject of Ganshui Site is completed with an estimated duration of no less than 150 days.
		Phytoremediation	● Repair plant nursery and primary growth	40 days	
			● Pretreatment of contaminated soil (mixed with activated sludge, peat and other auxiliary materials)	2 days	
			● Transplanting of seedlings	1 day	
			● Phytoremediation	500 days	
6	Remediation Scheme II	Co-disposal in Cement Kilns	● Encapsulation of collected contaminated soil during Small-scale treatment phase	3 days	
			● Contaminated soil transported to Lafarge Cement Plant	2 days	
			● Co-disposal of cement kilns for contaminated soil	30 days	

7	Validation checks and reviews	● Project validation ● Project Review	10 days	

6. Uncertainty Analysis of Implementation of Remediation Subproject

The implementation of remediation subproject of Ganshui Site still has some uncertainties, which include the following aspects:

(1) Uncertainties of integrity of collecting early data: Ganshui Site was built in the early 1960s and once was used to store pesticides and other agricultural supplies. Due to lack of historical data, data concerning types, quantity and specific locations of pesticides once stored in the warehouse and data concerning pesticide spills can only be brought forth through memories of related staff, which led to some uncertainties of the project's target pollutants and contaminated areas.

(2) Uncertainties of types of site land: Although the initial planning for overall construction of the area around Ganshui Site has been put in place, due to the smaller size of the site, the detailed planning for actual development has not yet been drafted and there may be possible for future adjustment of land use planning, resulting in uncertainties in drafting risk assessment and remediation plans;

(3) Uncertainties in risk assessment: The project adopts international risk assessment methods, however, the choices of pollutants' toxicity parameters, ways of site exposure and exposure parameters are likely to have some uncertainties;

(4) Uncertainties of repair range: Due to lack of early historical data of the site as well as differences in the spatial distribution of pollutants, the repair range of Ganshui Site may have some uncertainties;

(5) Uncertainties of repair effect: The project adopts anaerobic microbial degradation and phytoremediation for demonstrations, whereas both have not yet been applied in domestic site remediation projects. Meanwhile, considering differences of physic-chemical properties of soil and strictness of remedial targets, the repair effects now face greater uncertainties.

(6) The impacts of Lafarge cement production upon the implementation of the remediation plan are uncertain, which are mainly manifested as cement dust settling influences the growth of plants;

(7) Uncertainties of costs and cycles: Remediation work for contaminated sites is rather complicated. Though this subproject's remediation plan has carried out a detailed cost analysis and made arrangements regarding construction time schedule, however, due to some non-technical factors (such as being hit by torrential rains during the construction period, the results of validation check indicate that the needs to expand repair range, etc.), there may be discrepancies between actual repair costs and cycles and the well-planned ones.

7. Environmental and Social Management Plan

7.1. Purpose and Content of Environmental Management Plan

During the remediation of POPs contaminated site, it shall comply with the security policies of the World Bank, particularly OP 4.01 – Environmental Assessment and OP 4.12 – Involuntary Resettlement. The environmental management plan shall be prepared in accordance with the requirements of Environmental and Social Management Framework (ESMF) and implemented in light of EHS (environment, health and safety) guideline of the World Bank.

Based on the determination of technical scheme about Ganshui site remediation and management system of Ganshui site remediation sub-project (including the competent administrative department of the government, supervision and validation department, investment unit, the Employer and design unit, etc.), know about specific requirements proposed by local competent department in charge of environmental protection, occupational health and work safety, formulate a set of management strategies that are feasible technically and economically and have management operability for potential negative impacts of Ganshui site remediation sub-project on the environment, health and safety so as to make this sub-project comply with laws, regulations and standards of the World Bank and China regarding environment, health and safety.

The contents of the ESMF: propose the corresponding mitigation measures and Emergency response plans against the potential secondary pollution (including atmospheric environment pollution, surface water environment pollution, groundwater environmental impact, soil environment pollution, noise impact, solid waste, ecological environment impact, etc.), occupational health (considering the occupational health risk caused by the dust and toxic substances, physical occupational hazard risk, etc.), safety (including, vehicle damage, mechanical damage, electrocution, drowning, scalding, fire, falls from a height, collapse, flooding, explosion, etc.) and social impact, make clear and fulfill the duties and work division of the Employer, contractor, engineering supervisor and monitor and other units, develop the environment monitoring plan and training program, record the progress of the project, the execution situation of environmental management plan, the environment monitoring results, and report them to the relevant authorities in time.

7.2. Setting and Responsibility of Organization

According to regulations of the World Bank and China in relation to remediation management of contaminated site and actual engineering demands, environmental management system, in which management organization, supervision organization, consulting and service organization and implementation organization cooperate with each other, has been established for Ganshui site remediation sub-project, which is shown in Figure 29.

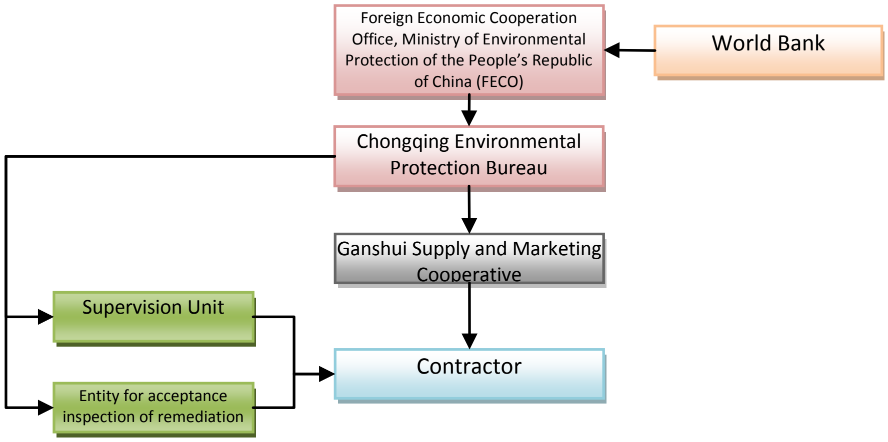


Figure 29 Framework Diagram of Project Management Organization

(I) Responsibility of World Bank

(1) The environmental and social technical experts shall be dispatched to specially check the implementation of site governance projects in accordance with the requirements of the loan agreement signed between Chinese government and the World Bank;

(2) Check the execution condition of loan agreement of the project, implementation condition of the environment management plan, etc.

(II) Foreign Economic Cooperation Office, Ministry of Environmental Protection of the People's Republic of China (FECO)

Take charge of the overall coordination and management work of the Contaminated Site Remediation Project of China, mainly including:

(1) Guide and supervise the work of Chongqing projects;

(2) Take charge of arranging the investigation activities of environmental experts of the World Bank;

(3) Summarize the reports of site remediation at different stages and submit them to the World Bank for review according to the requirements of the World Bank;

(4) Engage environmental consulting experts to provide technical support for site remediation;

(III) Chongqing Environmental Protection Bureau

As the competent authorities of environmental protection, Chongqing EPB shall supervise and administer the whole environmental process of the site governance project according to the laws, mainly including:

(1) Approval of the site assessment report;

(2) Environmental supervision and management of the remediation project at various stages, such as implementation and validation.

(3) Publicize the information of site remediation sub-project and accept the public opinions;

(4) Be liable for Foreign Economic Cooperation Office, Ministry of Environmental Protection of the People's Republic of China in relation to Ganshui site remediation project.

(IV) The Owner of Ganshui site

The Owner of pesticide POPs contaminated site of Ganshui Supply & Marketing Cooperative in Qijiang District of Chonging is Ganshui Supply & Marketing Cooperative of Qijiang County in Chongqing, with a clear property right and without any lease contract.

(V) Project office of Chongqing

The Employ is responsible for the implementation and management of remediation sub-projects in Ganshui site, mainly including:

(1) Designating the special persons for the environmental management work;

(2) Preparing the environmental management periodic reports of the remediation project and reporting them regularly to the FECO and the World Bank;

(3) Reporting to Chongqing Environmental Protection Bureau, coordinating with other departments to solve the major environmental problems;

(4) Determining the contractor of Ganshui site remediation sub-project by means of public bidding and execute relevant construction contracts with remediation contractor.

(5) Engaging the environmental supervision unit to supervise the implementation of remediation project by contractor by means of public bidding;

(6) Engaging the third party for validation by means of public bidding after the completion of remediation project by contractor;

(7) Engaging environmental and social experts to solve technical and social problems occurred in the implementation process of project;

(8) Receiving environmental work inspection, arranging the public investigation and public participation activities during the implementation process of sub-projects, answering doubts raised by the public and dealing with appeals of the public;

(9) Miscellaneous (document management, department coordination, publicity, reporting, etc.).

(VI) Contractor

The Contractor is the implementation organization of the remediation project and the main responsibilities include:

(1) Formulating remediation implementation scheme of Ganshui site on the basis of requirements of agent owner (Chongqing project office) and preparing the implementation rules and engineering implementation scheme on the basis of requirements in environmental management plan after the approval by Chongqing Environmental Protection Bureau;

(2) Implementing the environmental and social mitigation measures in the environmental management plan;

(3) Accepting the supervision and management of Chongqing project office, Chongqing Environmental Protection Bureau, environmental supervision organization, etc., and rectifying the unqualified parts in time;

As for the site remediation activities, the contractor shall meet the following requirements:

- In accordance with national or local laws and regulations and technical guidelines in relation to management and disposal of hazardous waste, the contractor is required to have qualifications to dispose of hazardous waste for satisfying the demands of Ganshui site concerning POPs and remediation of land polluted by heavy metal.
- The contractor shall have professional technical and management personnel with certifications as required, and sophisticated safety guarantee measures. The sophisticated safeguard measures include Technical Specification Manual for Remediation Activities, Liability Warranties of Safety and Project Quality, Occupational Safety Training and Appraisal, Security Equipment Management Regulations, Internal Patrol Rules of Environment, Quality and Safety, Safe Accident Emergency Regulation, etc.

- Other qualification requirements will be listed in the bidding documents of the project in detail.

(VII) Supervision Unit

The third party supervisor shall be responsible for engineering supervision and environment supervision, and the specific contents are as follows:

(1) Engineering supervision

Engineering supervision means the supervision and management over field engineering quality, engineering cost, engineering progress, construction scope and work safety management in accordance with requirements specified in *Supervision Specifications for Construction Engineering* (GB/T 50319-2013).

- Supervise whether structure reinforcement and protection of storage warehouse of pesticide at Ganshui site, peeling of wall on the surface layer of storage warehouse of pesticide, contaminated soil excavation at Ganshui site and construction of anaerobic biodegradation pool and phytoremediation site are conducted in accordance with construction scheme about remediation of contaminated site or not;
- Supervise whether sealing measures have been applied to vehicles used for the transportation of contaminated soil, or whether contaminated soil has been transported to designated place for storage and treatment based on predetermined transportation route and time, and check whether quantity of earthwork transported is consistent with that in transportation triplicate form or not;
- Control the scope of construction site boundary: check to see whether excavation and remediation of contaminated soil at Ganshui site is within the specified scope for controlling the occupation of temporary leased land.

(2) Environmental supervision

According to government supervision requirements and entrustment of agent owner (Chongqing project office), observe whether the contractor has implemented protection or mitigation measures for secondary environmental pollution as required during the remediation process or not, check to see whether remediation project has realized the effective control of secondary environmental pollution or reached corresponding standards or not, and provide image data of side station of which construction may cause major environmental or ecological pollution.

Main contents of environmental supervision are listed in the environmental management plan in detail.

(3) Qualification Requirements on Supervision Unit

Qualifications for engineering supervision: subject to *Qualification Management Regulations for Engineering Supervision Enterprises* (No. 158 order released by Ministry of Construction);

Qualifications for environmental supervision: as environmental supervision system has not been established and perfected in China and requirements on qualifications of environmental supervision units are not available, requirements may be proposed from the following aspects:

- Manage the qualifications of units engaged in the environmental supervision of construction projects. Such units may take part in the environmental supervision of construction project after the reviewing and affirmation by provincial administrative department in charge of environmental protection;
- Possess over B level qualification certificate concerning environmental impact assessment of construction project;

- Have over 3 engineering supervisors with over B level qualifications and more than 10 professionals majored in engineering analysis, environmental engineering, ecological protection and civil engineering;
- Equip with special instrument and equipment meeting the work requirements of environmental supervision;
- Establish perfect working regulations of environmental supervision, internal management system and archives management system;
- Provide certificates about working performance of environmental supervision. Other qualification requirements will be listed in the bidding documents of the project in detail.

(VIII) Entity for remediation validation

Entrusted by environmental management institution of the project (Chongqing Environmental Protection Bureau), entity for remediation validation will conduct validation over site remediation effects after the completion of site remediation project by the contractor, ensure that soil has reached the target remediation value after the remediation and prepare validation report.

Requirement on the qualifications of entity for remediation validation: in the absence of requirements on the qualifications of entity for contaminated site remediation validation in China, it may be considered in the following aspects:

- Have the permission to engage in the environmental consulting work, such as environmental impact evaluation and investigation and assessment of contaminated site, after the reviewing and affirmation by provincial administrative department in charge of environmental protection.
- Possess over B level qualification certificate concerning environmental impact assessment of construction project;
- Have more than 10 professionals majored in engineering analysis, environmental engineering, ecological protection and civil engineering;
- Equip with special instrument and equipment meeting the work requirements of environmental supervision;
- Establish perfect working regulations of environmental consulting, internal management system and archives management system;
- Possess the certificates of environment validation & supervision related work achievements. Other qualification requirements will be listed in the bidding documents of the project in detail.

(IX) Notes

- The project supervision and environment supervision must belong to different units.
- The project supervision unit, environment supervision unit and project validation unit must be employed through a competitive bidding of the project.

7.3. Progress Management

(1) The construction manager of the project management team shall decompose the construction period of the project and make clear the construction period requirements of various subprojects in accordance with the construction period requirements of the contract signed with the Employer. The construction manager shall propose the Control Outline for Project Schedule while preparing the Construction Organization Design and report it to the project manager for approval.

(2) Change of Regular Schedule: after receiving the application or request of Change of Regular Schedule, the project manager shall arrange the construction manager to organize the audit; if the change is needed, the construction manager shall fill out and report the Notice for Change of Project Schedule to the project manager for approval before the change is made;

After the Notice is approved by the project manager, the construction manager shall issue the Notice for Change of Project Schedule to various project subcontractors.

(3) Change of Major Schedule: after receiving the application or request of Change of Major Schedule, the project manager shall arrange the construction manager to organize the audit; if the change is needed, the construction manager shall fill out and report the Notice for Change of Project Schedule to the project manager for audit and report it to the supervision company for approval. After the Notice is approved by the supervision unit, the construction manager shall issue the Notice for Change of Project Schedule to various project subcontractors.

7.4. Influence of Lafarge cement production on site remediation

As contaminated soil remediation site of Ganshui site, Lafarge cement plant makes the following judgment based on remediation technology program:

- Sedimentation of dust caused by cement production is likely to affect the plant production in the plant remediated area and pollutants in the sol;
- Water seal is used for anaerobic biodegradation and surface of degradation pool is covered by impermeable membrane or wooden plate. Therefore, sedimentation of dust caused by cement production does not have any influence on the implementation of such remediation program.

(1) Impact of cement dust fall on soil pollutants to be remediated

According to analysis of general monitoring factors of Lafarge cement plant, its influence on remediation demonstration site is represented in the aspects of exhaust gas and noise, which is shown in Table 40.

Table 40 Environmental Monitoring Factors of Lafarge Cement Plant and Remediation Demonstration Site

Lafarge Cement Plant			Remediation Demonstration Site	Possible impact
Type of pollutant source		Monitor the pollution factor	Monitoring Factor	
Waste gas	Organized emission source	Dust (smoke), sulfur dioxide, oxide (calculated based on NO_2), fluoride	——	Dust of cement plant is sedimented and falls on phytoremediation area
	Unorganized emission	Total suspended particles	Total suspended particles	
	Sensitive point	Inhaled particles	——	
Waste water	Discharge outlet	pH, COD, BOD, LAS, SS, petroleum, fluoride, ammonia nitrogen and water temperature	No emission of waste water	No impacts
Noise	Noise at Boundary	Equivalent sound level	——	Sound intensity superposition of noise source
	Noise at sensitive point	Equivalent sound level	Equivalent sound level	
	Noise source	Equivalent sound level	——	

Discharge quantity of pollution factors of cement plant, such as particulate matters in the exhaust gas, sulfur dioxide, nitric oxide (calculated based on NO_2) and fluorides, shall be consistent with *Emission Standard of Air Pollutants for Cement Industry* (GB4915-2004). In addition to the said general monitoring indexes, other pollutants discharged by Lafarge Cement Plant include Dioxin with maximum discharge concentration being 0.016 ngTEQ/Nm^3; arsenic, nickel and other compounds (calculated based on As+Ni) with maximum discharge concentration being 2.06×10^{-2} mg/m^3; chromium; chromium, tin, antimony, copper, manganese and its compound (calculated based on Cr＋Sn＋Sb＋Cu＋Mn) with maximum discharge concentration being 5.84×10^{-2} mg/m^3; Mercury and its compounds, lead and its compounds, cadmium and its compounds are not detected (Attachment 13: *Related Materials of Lafarge Cement Plant*). Its discharge quantity is lower than that specified in *Control Standards for Incineration Pollution of Hazardous Wastes* (GB18484 -2001).

According to the maximum limiting emission value of cement kiln and in consideration of local dust sedimentation speed, gas-phase matters and sedimentation method of dust, maximum value of dust fall quantity of cement plant within 45° fan-shaped 1000 m scope along the downwind direction is calculated to be 12.3 g/m^2/month based on the dust fall mode of cement plant. Suppose that dust fall accumulated on the surface layer of soil (10 cm) will not run off, phytoremediation area is determined to be 200 m^2 temporarily and remediation time is decided to be 1.5 years, accumulative dust of Lafarge cement plant is estimated to be 44.28 kg.

As the volume of BHC-contaminated soil of Ganshui site is 31.4 m^3, total weight of phytoremediation soil is approximate 7.69×10^4 kg based on the Chongqing soil density of about 2.45 g/cm^3. Therefore, the content of cement dust in the soil is 0.5 g/kg, while composition of raw materials of ordinary Portland cement is shown in Table 41. Among these, As, Ni, Cr, Sn, Sb, Cu and Mn are basically within the background contents of minerals. Hence, dust mainly consists of $CaCO_3$, CaO, SiO_2, Fe_2O_3, Al_2O_3, MgO, Na_2O and K_2O. Increase of phytoremediation of soil contaminated by heavy metal and other organic pollutants caused by sedimentation of cement dust is very little, far lower than remediation interference value of contaminated soil. However, from the conservative perspective, it had better elect the construction of simple greenhouse and conduct phytoremediation inside the greenhouse.

Table 41 Production Raw Materials of Portland Cement

Types		Name	Remarks
Main materials	Limestone raw materials	Limestone, chalk, shell, muddy limestone, acetylene sludge, sugar, lime sludge, etc.	Used for the production of cement clinker
	Argillaceous raw materials	Clay, loess, shale, phyllite rock, river silt, coal ash, etc.	
Corrective raw materials	Iron corrective raw materials	Pyrite dross (iron powder), iron ore, copper mine slag, etc.	
	Siliceous corrective raw materials	River sand, sandstone, siltstone, diatomaceous earth, etc.	
	Aluminum corrective raw materials	Furnace clinker, coal gangue, bauxite, etc.	
Additive	Mineralizer	Fluorite, fluorspar-plaster, pyrite, metallic tailings, etc.	
	Seed crystal	Clinker	
	Grinding aid	Waste fluid of sulphite pulp, triethanolamine scraps, sodium acetate, etc.	Raw materials, cement grinding unit
	Slurry diluent	CL-C slurry diluent, CLT slurry diluent, etc.	Used when wet method is used for production
Fuel	Solid fuel	bituminous coal and anthracite	Coal is commonly used in China is fire coal
Delayed coagulation materials		Plaster, anhydrite, ardealite, industrial by-product plaster, etc.	Cement composition
Mixed materials		granulated blast-furnace slag, limestone, etc.	Cement composition

(2) Impacts of cement dust fall on phytoremediation

Atmospheric pollution caused by cement plant is mainly represented by dry deposition of dust and smoke particulate matters on surrounding environment. Given the local dust sedimentation speed, gas-phase substances and dust sedimentation method, maximum value of dust fall quantity of cement plant is determined to be 12.3 g/m^2/month within 45º fan-shaped 1000 m scope along the downwind direction based on the dust fall mode of cement plant. If it is accumulatively estimated based on remediation time of 1.5 years, cement dust will form a layer of dry shell on the leaves, branch and flowers of vegetation, therefore blocking pores, affecting the photosynthesis and reducing the physiological indicators of vegetation: lowering Chlorophyll, making chlorophyll reduce, leaves become yellow and leaf opex withered, leading to premature senility of basal leaves, putting down plant, shortening most productive period and decreasing the height, diameter at breast height and timber volume of trees.

To sum up, impacts brought by dust fall must be considered when phytoremediation of contaminated soil is selected for Lafarge Cement Plant. Its mitigation and prevention measures are to build simple greenhouse and conduct phytoremediation inside this greenhouse.

7.5. Impacts of the Environment, Health and Society and Mitigation Measures

According to remediation technology scheme of Ganshui site, its remediation sub-projects include peeling of building, evacuation of contaminated soil, packaging, transportation, temporary storage, remediation, possible occurrence of secondary environmental pollution (atmospheric pollution, underground water pollution, surface water pollution, soil pollution, noise pollution, solid waste pollution and waste water), occupational health risks, safety risks and social impacts. Refer to Table 42 for such specific impacts and mitigation measures proposed.

Table 42 Actions for Mitigation of Environmental and Social Impacts of Remediation sub-projects in Ganshui site

The activities of sub-projects	Potential impact	General mitigation action	Implemented by	Supervision organization
I. Secondary environmental pollution				
Evacuation engineering of contaminated soil of Ganshui site	As evacuation construction is conducted manually indoors and noise and fugitive dust impacts caused will not go beyond the site boundary (inside Ganshui warehouse), population affected by them are mainly operators, which are mainly represented as follows: ● Fugitive dust generated during excavation of contaminated soil ● Fugitive dust generated during package of contaminated soil ● Fugitive dust caused by peeling of surface layer wall inside storage warehouse of pesticide; ● Glove that may have contaminated soil, mask and duster cloth used for wiping tools; ● Such evacuation engineering will not generate waste water; ● As value of noise caused by manual evacuation does not exceed 70dB, it can be neglected;	(1) Before the peeling of surface layer wall inside storage warehouse of pesticide, it is needed to make wall wet for reducing the occurrence of fugitive dust; (2) If moisture contents of contaminated soil are relatively small, spray water before the package to reduce the occurrence of fugitive dust; (3) Make package immediately after the excavation of contaminated soil to decrease the occurrence of fugitive dust; (4) Workers are required to take off frock and work shoes before leaving the site; (5) Collect wastes, such as gloves, mask and duster cloth, and submit to the contractor for unified treatment in accordance with provisions concerning polluting waste; (6) Provide special training about BHC-contaminated soil and emergency measures; (7) For non-evacuation area inside site, use water-proof double-layer colorful stripes (or impermeable membrane) to lay the ground and use plastic cloth to cover the wall;	Contractor	Project management authority of Chongqing, Chongqing Municipal Environmental Protection Bureau, and environmental supervision entity
Transportation process of Contaminated Soil	Impacts during the transportation process of contaminated soil mainly include noise, tail gas, traffic and impacts generated by scattering of contaminated soil and its impact scope does not go beyond 20-50m at both sides of road; population affected by it are mainly residents along the road and transportation driver. Specific details are depicted as follows: ● Impacts of noise, tail gas and fugitive dust discharged during the driving process of vehicle on the surrounding residents; ● Loading and unloading of contaminated soil may block the surrounding road; ● Tyres of transportation vehicle may carry contaminated soil; ● There may be volatile pollutants affecting the health of driver during the transportation process of contaminated soil; ● In case of accidents in transit, contaminated soil will be scattered, leading to dispersion of pollutants;	(1) Transportation vehicle is under good condition and passes annual inspection successfully. Release of tail gas by transportation vehicle is up to standard and driver possesses vehicle license and driving license; (2) Loading and unloading and transportation of contaminated soil by transportation vehicle shall avoid peak traffic hour; (3) Vehicle routing is designed inside construction site to prevent cross contamination. When leaving the construction site, vehicle must be washed and shall not carry mud for avoiding the fugitive dust; (4) Transportation vehicle shall avoid driving at night for minimizing the impacts of noise on the surrounding residents; (5) Transportation driver shall wear glove, mask and protective garment; (6) Emergency program shall be formulated for accidents and contaminated soil will be collected and disposed of in time; (7) Trucks for soil transportation shall be covered with tarpaulins and shields. Overspeed is forbidden, so as to avoid falling and fugitive dust of the contaminated soil; (8) Special training about BHC-contaminated soil and emergency measures will be provided.	Contractor	
Temporary Storage Of contaminated soil	Affected scope of temporary storage of contaminated soil is only confined to storage warehouse. Its environmental impacts are mainly soil, water and atmospheric impacts and the scope of its impacts is within 50-100m of remediation demonstration area. Population affected by it is mainly warehouse keeper. Specific details are described in the following:	(1) Inspect the conditions of hermetic bag used for storing contaminated soil on a regular basis. Once hermetic bag is found to be damaged, replace it in a timely manner; (2) Use hermetic bag to collect scattered contaminated soil in time; (3) Provide ventilation system inside storage warehouse and contaminant collection device in the air (absorbed by activated carbon);	Storage site	

	● Hermetic bag is damaged during the storage process of contaminated soil, leading to scattering of contaminated soil, flowing of leachate and overflow of volatile gas and endangering the people's health.	(4) Restrict the access of storage warehouse personnel strictly and implement safety protection measures, such as wearing gas mask, protective garment and gloves; (5) Examine the health of warehouse keeper on a regular basis; (6) Provide special training about BHC-contaminated soil and emergency measures		
Impacts of Lafarge cement production on remediation demonstration engineering	Impacts of Lafarge cement production on remediation program I are mainly represented as follows: ● Dust caused by Lafarge cement production falls on the leaves of vegetation, thereby lowering the physiological index of vegetation; ● Noise caused by Lafarge cement production may overlap with noise generated by the implementation of program I, thereby increasing the noise; ● Lafarge cement production does not cause waste water, exhaust gas and solid wastes for program I; In the remediation Scheme II, cement kiln incineration technology is used, which is consistent with cement production process. Therefore, cement production and remediation program II do not have impacts on the each other.	(1) Build simple greenhouse and conduct phytoremediation of contaminated soil inside the greenhouse; (2) Keep remediation demonstration site away from noise source of Lafarge cement production;	Contractor	
Remediation program I: anaerobic biodegradation and phytoremediation	As scope of impact brought by two kinds of environmentally friendly technology, namely anaerobic biodegradation and phytoremediation, is confined to Lafarge cement plant, scope of impact of its waste water, noise, tail gas and solid waste is within 50-100m of remediation demonstration area; population that are likely to be affected by it are mainly workers of cement plant and staff responsible for remediation with specific details in the following: ● Contaminated soil undergoes rain leaching during the phytoremediation process, thereby generating the waste water containing pollutants; ● The waste water containing BHC that is produced in the anaerobic biodegradation remediation may cause the pollution to the surface water; ☐ ● Cleaning of equipment, tools and devices during the remediation construction process of contaminated soil may lead to waste water; ● After the screening of contaminated soil, it is necessary to clean the stone of which surface is covered by contaminated soil and waste water generated may contain BHC and arsenic pollutants; ● Fugitive dust caused by engineering machinery construction of phytoremediation of contaminated soil and anaerobic organism remediation may cause pollutants to spread or diffuse with it; ● Tail gas discharged by transportation vehicle and excavator used during the remediation process may give rise to atmospheric pollution;	(1) Follow the specified route for the transfer of contaminated soil inside Lafarge cement plant and arrange workers to clean the soil scattered along the road; (2) Establish drainage ditch and rain collection system inside remediation site of contaminated soil; (3) Build sewage treatment unit at remediation site of contaminated soil to dispose of waste water containing BHC and arsenic (rainwater and waste water generated by cleaning). Use treated waste water to irrigate phytoremediation area and do not discharge such waste water to outside area; furthermore, collect the sediment caused by disposal of waste water for phytoremediation; (4) Machinery equipment used during the remediation process shall meet corresponding discharge standards of tail gas; (5) Keep remediation demonstration site away from office area and living quarters of Lafarge cement plant and dense area of surrounding residents to minimize the impacts of noise on the workers of Lafarge cement plant and surrounding residents; (6) Arrange the construction procedure reasonably. Night work shall be avoided generally under the premise of ensuring the construction progress, thus preventing influences the neighboring residents and workers of Chongqing Lafarge Cement Plant at night; (7) Operators near the machine with high noise are required to use relevant articles to control noise, such as wearing earplug. Shorten working hours at high-noise area and arrange workers to work at high-noise area in turn; (8) Select the construction equipment with little noise as much as possible, apply sound insulation measures at the boundary of construction site, preserve the original vegetation as much as possible and conduct afforestation and take noise control measures, such as adding resilient cushion member, cladding and acoustic shield; (9) Remediation construction shall avoid high wind weather and dust control measures shall be applied during the construction process, such as wet painting or covering; conduct phytoremediation at simple greenhouse to minimize the diffusion	Contractor	

	● Transportation vehicle and excavator used during the remediation process may give rise to noise; ● During the handling process of contaminated soil inside Lafarge cement plant, hermetic bag used for the storage of contaminated soil may be damaged, thereby making contaminated soil scattered; ● If residual materials of auxiliary materials used for the remediation of contaminated soil, such as dried blood, zero-valent iron and activated sludge, are not disposed of properly, it may cause pollution to surrounding environment; ● Soil disposal after the remediation: although its environment and health risks have reached the controlled level, it still poses certain environment and health risks.	of pollutants caused by fugitive dust; (10) Manage and control the auxiliary materials used during the remediation process of contaminated soil in a standard manner, establish corresponding storage area, recycle and preserve remaining materials for avoiding the pollution to surrounding environment; (11) After the remediation, soil has reached the target value and environment and human health risks brought by it are controllable. However, from the conservative perspective, use soil after remediation for resuming plantation or for building roads. It is not suggested to backfill such soil and use as agricultural soil; (12) Require remediation workers to wear glove, mask and protective garment; (13) Set warning sign and guardrail at the remediation area and restrict the access of non-remediation workers to it; (14) Provide special training about BHC-contaminated soil and emergency measures		
Remediation program II: incineration at cement kiln	When contaminated soil is sent into and incinerated at cement kiln, health of workers may be affected; ● During the handling process of contaminated soil inside Lafarge cement plant, hermetic bag used for the storage of contaminated soil may be damaged, thereby making contaminated soil scattered; ● When contaminated soil is mixed and ground with cement raw materials, fugitive dust may be caused; ● Dust caused by incineration of contaminated soil and discharged to atmosphere is likely to lead to pollution; ● After the co-disposal of contaminated soil at the cement kiln, pollutants may be transferred to finished cement; ● Incineration of contaminated soil at cement kiln does not generate new waste water, waste residue and noise;	(1) Ensure that project concerning incineration and treatment of contaminated soil at cement kiln passes environmental impact assessment and feasibility of contaminated soil processed by it, accessibility of remediation goal and environmental compatibility are reviewed by environmental protection bureau; (2) Ensure that dust-removing equipment is provided for incineration treatment of contaminated soil and quick cooling system is capable of reducing the temperature of high-temperature flue gas to be lower than 200°C for avoiding the occurrence of Dioxin; (3) Follow the specified route for the transfer of contaminated soil inside Lafarge cement plant and arrange workers to clean the soil scattered along the road; (4) Use machine to conduct feeding process of cement kiln automatically; (5) Conduct the mixing and grinding of contaminated soil and cement raw materials inside sealing equipment; (6) Provide dust-collection device for incineration at cement kiln; (7) Detect the exhaust gas caused by incinerator of cement kiln on a regular basis; (8) Conduct product testing before finished cement leaves the factory to detect whether pollutants have transferred or not; (9) Establish strict working procedure and rules and regulations for the incineration disposal of contaminated soil at cement kiln; (10) Require the operators responsible for incineration disposal of contaminated soil at cement kiln to use personal protective equipment, such as mask, protective garment and glove; (11) Deal with waste water, waste residue and noise caused by incineration treatment of contaminated soil at cement kiln according to process measures of cement production; (12) Provide special training about BHC-contaminated soil and emergency measures	Lafarge Cement Plant	
		II Community health and safety		
Society	● Impact on daily life of the local residents ● Impact of transportation of contaminated soil at site on road traffic ● Temporary relocation of one household, thereby affecting its normal life	(1) Negotiate with the local residents and the those influenced, listen to their opinions and suggestions carefully, respect and protect their legal rights and benefits, take actions for compensation and resettlement according to the applicable policies, regulations and the actual conditions. (2) Erect barriers around the construction site, limit the range of construction strictly.	Contractor	Project management authority of Chongqing, Chongqing

	● Protection of Historical Relics: there is no remain or underground historical relic with archaeological research value in the contaminated site. ☐ ● Folk custom and religion: as population at Ganshui site are mainly Han Chinese, companies and workers will not have different folk custom, living customs or religious faith with those in the local area and will not lead to misunderstanding or contradiction during the remediation construction of Ganshui site	Hang the construction light at a height and in a direction without influencing rest of the surrounding residents at night. Plan the transportation route of construction materials reasonably. (3) Make sure there is no planting zone, culture zone, simple shed/house, water well/motor-pumped well or other structures and crops around the site, thus preventing loss of the surrounding residents or impact on their income. In case of unexpected property loss of some resident during construction, compensate him/her according to applicable national and local policies and regulations. (4) No permanent immigration and relocation will occur for this project, but it will cause the temporary immigrationaand formulate feasible resettlement plan, so the compensation work shall take into full consideration various aspects, such as, financial compensation, the improvment of living conditions, etc. (5) As for the damage or blocking of access roads of the residential area or residents, repair the road damaged after completion of the project, and reserve roads for the passengers and public vehicles during construction. (6) Avoid the transportation of contaminated soil at the peak traffic hour. (7) Formulate public participation plan during the construction period, solve social problems caused by construction; furthermore, set complaints hotline, e-mail and feedback mechanism; (8) If underground cultural relic is found during the remediation construction process, stop construction immediately and report to local cultural relic department according to relevant national requirements.		Municipal Environmental Protection Bureau, and environmental supervision entity
III Occupational health risk				
Dust	● Fugitive dust generated during the excavation, crushing, screening and mixing process of soil may lead to respiratory diseases of operators	(1) Follow the construction flow and technical requirements strictly; (2) Conduct wet method operation; (3) Strengthen individual protection. Wear dustproof devices when it is difficult to decrease the dust concentration to a level below the national standard level with the dust control and prevention actions. (4) Intensify education and training for the worker, field inspection and comprehensive management for dust control.	Contractor	Project management authority of Chongqing, Chongqing Municipal Environmental Protection Bureau, and environmental supervision entity
Toxic substance	● Target pollutants in the soil of Ganshui site are BHC and arsenic with high toxicity. If operators contact with them accidentally during the remediation process, it may cause human poisoning.	(1) Define specific personal health protection regulations and provide protective articles for operations with exposure to toxic substances, e.g. ventilate coveralls, canister respirators, chemical protective gloves, chemical protective shoes and so on. (2) Arrange professional doctors to examine and check the health of operators contacting with toxicants at predetermined time interval. If any abnormal physical change is found, receive treatment in time; (3) Provide education and training on specific knowledge for the operators before commencement, so as to get them familiar with the knowledge on hazards and the safety protection and grasp the protection methods;	Contractor	
Physical properties Hazard	● Damage to human health caused by noise and vibration generated after excavation and transportation at Ganshui site and construction at remediation site as well as unforeseeable and abnormal metrological conditions	(1) Take actions to eliminate or reduce the noise and vibration, e.g. welding instead of riveting, isolation materials of rubber, cork wood and sand, and to eliminate or reduce transfer of noise and vibration, such as noise absorption, insulation, vibration isolation, damping and so on. (2) Restrict the operation time and vibration intensity, improve the operation environment, and strengthen individual protection.	Contractor	

		(3) The workers shall keep away from the heat source or wear heatproof overalls when working in high temperature environment. Adopt open or semi-open operation to take advantage of natural ventilation for cooling, and provide health protection articles. Take actions for cold protection and thermal protection, and intensify use of personal protection articles.		
Other	● Physical fatigue caused by monotonous operation ● Chronobiology disorders caused by all-weather work in shifts	(1) Arrange the work reasonably. (2) Arrange the operators to have rest by turns, and avoid long-term operation at a fatigue state.	Contractor	
IV Safety risk				
Injurycaused by vehicle	● The motorized vehicles for remediation may strike or crush the human bodies during driving, causing falling, collapse and casualties	(1) Braking performances, power, operating stability, comfort, physical dimensions, vision and lighting of the vehicles shall meet the requirements of use. (2) Decrease driving speed of vehicle during the driving process and guarantee safe driving; (3) Formulate the Emergency response plan	Contractor	
Mechanical injurie	● Casualties caused by crushing, collision, cutting, twisting, bruise, puncture during exposure to various machines and equipment for remediation	(1) Re-design the machines to make the dangerous parts more visible or attach warning signs to them. (2) Consolidate the skill and safety training of workers and reinforce supervision management; (3) Formulate accident emergency scheme;	Contractor	
Electric shock	● Casualty accident of lightning stroke or electric shock that may be caused by current-consuming machinery required for remediation project	(1) Avoid the electric shock accidents caused by direct contact by means of insulation, safe shielding and safe spacing, and prevent the electric shock accidents caused by indirect contact by means of IT (protective grounding), TT (neutral solidly grounded) or TN (protective connecting neutral) systems. (2) Use explosion-proof electrical devices and circuits, and ensure the enclosure of electrical devices are in good conditions. (3) Equip all lightning protection structures with external and internal lightning protection devices, and take actions to prevent intrusion of lightning surge. (4) Consolidate the skill and safety training of workers and reinforce supervision management; (5) Formulate accident emergency scheme;	Contractor	
Burn	● If co-disposal technology at cement kiln is used for contaminated soil at Ganshui site, the temperature of its furnace body is between 1000°C ~2000°C, which may cause burn risks.	(1) Conduct operation in accordance with provisions strictly, consolidate the skill and safety training of workers and reinforce supervision management (2) Wear the personal protective articles, e.g. head protector, canister respirator, goggles, body protector, hand and foot protection devices, etc. (3) Formulate accident emergency scheme;	Contractor	
Fire	● Injuries and property loss caused by fire at the remediation site	(1) Use fire resistant construction materials. (2) Take actions of sun shading for the workshops and warehouses with explosion hazards, and install ground glass on the windows, so as to avoid formation of ignition source. (3) Prepare fire-fighting equipment suitable for the site, and set evacuation route, emergency convergence place, fire lane, emergency lighting and so on.	Contractor	
Collapse	● Earthwork collapse during the dredging of contaminated soil,	(1) Operate on a flat and rigid ground when possible.	Contractor	Project

	scaffold collapse during the contaminant removal of buildings(structures), collapse of stockyard materials on the construction site, etc.;	(2) Strengthen and reinforce the structure of existing wall of Ganshui warehouse; (2) The operators shall have certain work experience and wear safety helmet and other protective equipment; (3) Set warning signs to prevent unauthorized approaching. (4) Formulate the Emergency response plan		management authority of Chongqing, Chongqing Municipal Environmental Protection Bureau, and environmental supervision entity

7.6. Emergency Measures

In accordance with specifications and management rules about safety construction of building engineering of the country and Chongqing Municipality, analyze the potential risks, possible accident type and extent of injury at each construction link during the remediation process of Ganshui site, predict type, quantity and distribution conditions of accident potential and formulate corresponding emergency prevention measures for the remediation of site.

During the excavation, removal and remediation and governance process of contaminated site of Ganshui, it is necessary to prepare the emergency response plan, including fire emergency, accident emergency, flood control emergency, etc., as shown in Table 43.

Arrange mobilization safety training, explain emergency measure scheme, position of escape facilities and equipment and use method, define escape route, provide simple training on first-aid knowledge and establish emergency safety contact diagram. Set warning sign at the critical area of plant and use simple and easy-to-understand identification to prompt emergency escape scheme. Arrange emergency escape drills before the mobilization.

Table 43 Emergency Measures for Remediation of Contaminated Site

Name	Basis/Material for Emergency Response Plan	Specific Measure
Transport Emergency	● Establish the preparation funding system for emergency rescue disposal and bring it into the budget; ☐ ● Rescue equipment and facilities, such as, first-aid kits, emergency vehicles, protective clothing for hazardous waste, etc.; ☐ ● Communication equipment: transceivers, mobile phones, etc. ☐	● After the accident of transport vehicle in field area, check the severity of the accident and check the casualty condition, and if any, conduct the rescue immediately and intercept the passing vehicles to send the wounded to nearest hospital, and then mark the position of the accident site and set up the warning labeling; ☐ ● Timely Report: ☐submit official reports immediately or by entrusting the others to local public security department, traffic competent authorities, insurance company and the competent authorities of this company while rescuing the wounded and protecting the scene; ● Activate the emergency response plan, and the emergency group of project management team shall rapidly mobilize the personnel and equipment to rush to the scene, and assist the on-site investigation and accident analysis, and assist the traffic police to divert the vehicles. ☐ ● Command the staff and machinery to rapidly clean up the scene. ☐Clean up the ro taminated soil in time. It is prohibited for other transport vehicles to roll over the spilled contaminated soil to prevent the spreading of pollution.
Fire Emergency	● The fire emergency shall be carried out in accordance with the relevant provisions of the Fire Protection Law of the People's Republic of China, Administration Rules on Supervision of Construction Project Fire Prevention and Code for Design of Extinguisher Distribution in Buildings. ☐ ● Fire hydrant, extinguisher, fire warning apparatus, smoke mask, first-aid kits, etc. ☐	● The design arrangement of fire protection measures on the site shall also include the evacuation route, emergency assembly site, fire access and emergency lighting. ☐ The evacuation route shall choose the unblocked route facilitating the escape, and the width of fire access shall not be less than 4m. The emergency lights shall be provided near the emergency evacuation route, which can facilitate the evacuation and escape of the workers in case of any fire during nighttime construction. The emergency assembly site is initially proposed in the broad space in front of the office area. ● Fire Warning: in case of any fire, the fire alarm will sound to alert and arrange through the loudspeaker the evacuation of the groups possibly affected by the fire. ☐ ● Launch the advocacy of basic knowledge of prevention, risk avoidance, self-rescue, mutual aid, disaster prevention and mitigation and the relevant laws and regulations to improve the capacity and awareness of disaster prevention and relief. ☐ ● Call the local fire department to request the professional fire-fighting team to extinguish the fire; ☐ ● Stop the construction immediately, organize the evacuation and fire extinguishing according to the emergency response plan, timely contact the project manager, representative of the Employer and project management team to form the on-site management and disposal programs; ☐ ● Carry out the subsequent investigation and accountability, form the written materials and reports;

Accident Emergency	● Medical kits and gas masks; ☐ ● Emergency vehicles and equipment☐ ● Communication equipment☐	● Accident emergency includes burn, fire, collapse, electric shock, mechanical injury, vehicle injury, etc., with specific measures in the following: ● Call the local medical institution (120) to request the professional medical team; ☐ ● Stop the construction immediately, organize the evacuation and rescuing according to the emergency response plan, timely contact the project manager, representative of the Employer and project management team to form the on-site management and disposal programs; ☐ ● Launch the advocacy of basic knowledge of prevention, risk avoidance, self-rescue, mutual aid, disaster prevention and mitigation and the relevant laws and regulations to improve the capacity and awareness of disaster prevention and relief. ☐ ● Carry out the subsequent investigation and accountability, form the written materials and reports;
Flood Control Emergency	● Flood drainage, flood-control sandbags, drainage pumps, sheltered room, etc. ☐ ● Communication equipment☐ ● Emergency medical equipment and materials ☐	● Contact the local weather department in time to master the early warning information, including typhoons, rainstorms, landslides, etc.; ☐ ● Launch the self-correction and self-inspection of work safety and check the flood control and typhoon-prevention plans and material reserves before the flooding season and typhoons. ☐ ● Establish 24-hour emergency on-duty system; ☐ ● Launch the advocacy of basic knowledge of prevention, risk avoidance, self-rescue, mutual aid, disaster prevention and mitigation and the relevant laws and regulations to improve the capacity and awareness of disaster prevention and relief. ☐ ● Call the local flood-control office to request the assistance of professional team. ☐ ● Stop the construction immediately, organize the evacuation and rescuing according to the emergency response plan, timely contact the project manager, representative of the Employer and project management team to form the on-site management and disposal programs; ☐ ● Carry out the subsequent investigation and accountability, form the written materials and reports;

7.7. Resettlement Plan

According to the results of site survey and investigation of environmental and social impacts, it's found that the contaminated site at Ganshui is close to a house (the original dormitory of warehousemen). During the process of site excavation and transportation construction, it may have environmental and social impacts, such as noise, dust or entry and exit of vehicle and machinery, on residents living at this place. Therefore, it is required to resettle such residents temporarily during the remediation construction process of Ganshui site so as to avoid the adverse impacts on their life, health and safety.

According to public participation results before the publication of environmental assessment report of remediation sub-project of Ganshui site, residents of this household have known about the necessity of remediation of this site as well as its impacts on their life and living environment, and agreed with, understood and supported this sub-project. In addition, main appeals of residents of this household are as follows: (1) after the completion of site remediation, continue to live in this house; (2) do not disrupt their daily life. In particular, avoid the construction noise at night or during the rest time.

As property right of such house is held by Ganshui Supply and Marketing Cooperative (Attachment 14 *Instructions about the Provision of House Property Right by Ganshui Supply and Marketing Cooperative*), Chongqing project office has reached consensus with Ganshui Supply and Marketing Cooperative regarding the temporary resettlement of residents of this household with specific details in the following:

(1) House Protection Plan.

As house used by such residents adjoins to warehouse, it is necessary to support and protect warehouse wall by means of scaffold and foundation consolidation in the course of contaminated soil excavation at site to ensure that the house of such residents is stable and not damaged.

(2) Resettlement Plan during the Construction Period

Ganshui Supply and Marketing Cooperative will, one month prior to site clearing, notify residents of this household to relocate and provide them with relocation service and expenses required for 4-month temporary house renting and subsidy.

(3) Budget

Temporary resettlement expenses of Ganshui site are divided into two parts (Table 44).

Firstly, resettlement compensation expenses of residents affected by it are provided by Chongqing project office and its budget is determined by reference to relevant Chongqing standards, which are shown in Table 43. Among these, house renting fees are directly paid by Chongqing project office to landlord in accordance with rental agreement concluded between such residents and landlord. Subsidy expenses will be remitted by project office to account of such residents directly from bank before the 10th day of each month for total four months. Temporary resettlement compensation funds are generally from supporting funds of this project.

Table 44 Budget of Temporary Resettlement Plan of Ganshui site (Yuan)

Budget item	Amount
Rent for 4 months	800*4=3200
Compensation cost	400*2*4=3200
Total	6400

*Minimum living standard for urban residents at Qijiang County, Chongqing is 260 Yuan/people/month and subsidy for the remediation of Ganshui site is calculated to be 400 Yuan/people/month;
*The rent for one-room and one-hall suite (housing area of 60m^2 or so) in Qijang County is 800 Yuan/month.

Secondly, house protection expenses are incorporated in the expenses of construction link of site excavation (protection of building structure) and will not be listed repetitively.

(4) Implementation and Monitoring of Resettlement Plan

Implementation Time: fulfill the aforesaid resettlement compensation measures at least two weeks before the remediation and cleanup of the site;

Implementation monitoring: revisit the residents of this household one week prior to excavation construction of Ganshui site, know about the feedback opinions about temporary resettlement measures and payment of subsidy funds as well as treatment results of problems reflected from residents.

Report of implementation result: monitoring report (in both Chinese and English) shall be submitted by Chongqing project office to Foreign Economic Cooperation Office, Ministry of Environmental Protection of the People’s Republic of China (FECO) (Foreign Economic Cooperation Office will forward it to the World Bank) within one week after the completion of excavation construction at Ganshui site or at latest within the current month. For leftover problems of social impacts caused by resettlement, Chongqing project office will, within half a year or at latest before the completion and validation of such sub-project, coordinate to solve such problems and submit written report on treatment process and results to Foreign Economic Cooperation Office, Ministry of Environmental Protection of the People’s Republic of China (FECO).

7.8. Environmental Supervision during Ganshui site Remediation

7.8.1. Organization Chart of Environmental Supervision

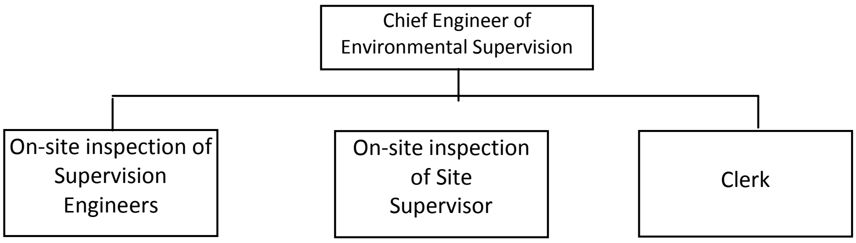


Figure 30 Organization Chart of Environmental Supervision

Organization Chart of Environmental Supervision is shown in Figure 30:

- One Chief Engineer of Environmental Supervision: take charge of the overall coordination work, approve the shutdown of the site remediation subproject, issue the contact sheet of environmental supervision work, rectification notice of environmental supervision and suspension/return-to-work/reworking notices of environmental supervision, verify and issue the environmental supervision program, detailed rules for implementation of environmental supervision program, Environmental Supervision Report, assist in completing the validation and participate in project change.
- One on-site engineer of environmental supervision: prepare the environmental supervision program and detailed rules for its implementation and take charge of preparing the routine working reports. ☐
- Several supervisors: daily patrol and check the prevention and control measures of mechanical construction noise on the site, prevention and control measures of air pollution, prevention and control measures of solid waste and prevention and control measures of ecological pollution, and take charge of monitoring the pollution indicators and collating and summarizing the monitoring data. ☐
- Clerk: take charge of registration and filing of supervision materials, manage and control site environment monitoring device.

7.8.2. Work Methods of Environmental Supervision

On the basis of formulating environmental supervision program, conduct environmental supervision and management over the whole remediation process by means of verification, patrol inspection, side station, follow-up inspection, monitoring, meeting, information feedback, records, video, photograph, supervision log and report etc.

On implementation stage, engineering acceptance stage and soil re-use stage after the remediation:

- Verification: verify whether remediation project has been implemented according to remediation program or not. Pay attention to check the change of positional relation between remediation project and relevant sensitive area and observe whether environmental protection measures for environmental sensitive area are applied well or not.
- Patrol Inspection: the environmental supervision unit shall patrol the implementation of the remediation project to master the actual condition and progress of the project, and find out the problems of project compliance and environmental protection qualified rate and propose the suggestions on the site, and then make the on-site patrol records. ☐
- Side station: when some projects that involve environmental sensitive area and are likely to have large influence on surrounding environment or have major potential safety hazards are being conducted, side station is needed for environmental supervision. As it is required to preserve the existing building at Ganshui site, there

may be major potential safety hazards in the excavation project of contaminated soil and environmental supervision unit shall take site follow-up supervision activities for such construction.

- Follow-up Inspection: it is recommended for the construction unit to rectify any problems found during the patrol inspection and on-site supervision, and after completing the rectification of the related environmental problems, the follow-up inspection shall be carried out for the rectification situation of the corresponding problems. ☐
- Environmental Monitoring: the environmental monitoring unit shall carry out the simple on-site environment monitor through the portable environment monitoring instrument; it is recommended for the construction unit to additionally entrust the qualified unit to carry out the more complicated environmental monitoring operations. ☐
- Supervision meeting: regular supervision meeting is the important way for supervision unit to conduct supervision work. Construction unit shall report the construction contents of this stage and construction plan of next stage. Supervision unit shall collect and summarize incidents and problems occurred during the construction process of this stage, consult to solve problems that shall be solved in the regular meeting and formulate implementation measures.

Apart from the regular supervision meetings, the environment supervision unit can convene the special conference for certain problem and the attendees shall make the discussion against the specific problem and propose the united solution for the specific problems after summarizing the opinions.

- Information Feedback: the environment supervisors shall immediately notify the on-site officer of the contractor to correct and rectify any environment pollution problem found by the supervisors during their patrol inspection.
- Records and reports: the environment supervisors will fill in daily site records and prepare regular work report according to progress of works; if it is inconsistent with program during the implementation process of remediation project, environmental protection measures are not implemented well or other major environmental protection issues have occurred, it is needed to make special report on environmental supervision; furthermore, it is required to prepare and submit environmental supervision report after the completion of site remediation and regard it as important annex in the final acceptance report of site.
- Correspondence System: the environmental supervisors can use the Work Contact Sheet of Environmental Supervision while making the work coordination with the construction units. The work contact sheet shall indicate the matters, contents, causes and opinions of environment supervisors. The receiver unit of the work contact sheet shall carry them out according to the requirements. If the receiver unit fails to satisfy the requirements, it shall return a receipt in time and the causes of failing to satisfy the requirements and other solutions shall be explained in the receipt. In case of any more seriously affected environment, the environment supervision unit shall issue the environmental supervision instructions to the construction units through the Rectification Notice of Environmental Supervision, and the construction units must return the receipts to the environmental supervision unit after receiving the Notice.

7.8.3. Environmental Supervision Contents

The supervision contents are determined according to the environmental supervision program provided by the third party environmental supervision unit:

(1) Document Review

According to construction organization program and official reply documents given by competent environmental protection management authority, check and review documents about special program of emergency protection or environmental monitoring, verify archives records and storage conditions during the site excavation and implementation process of contaminated soil remediation. In general, verification is conducted in accordance with the following procedures shown in Figure 31.

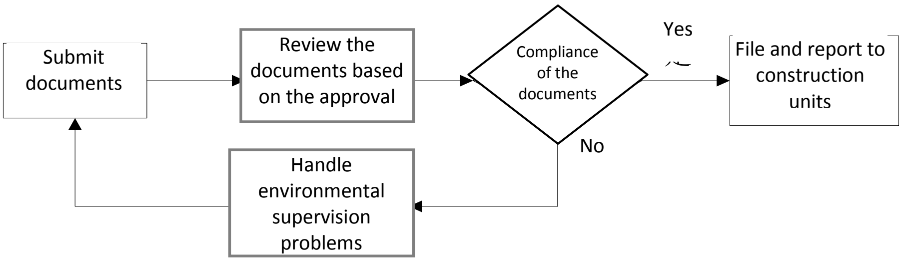


Figure 31 Review Procedures of Environmental Supervision Documents

(2) Monitor the mitigation measures of secondary environmental pollution

Environmental supervision is mainly targeted at implementation of prevention and mitigation measures of secondary environmental pollution caused during the remediation process of Ganshui site and its purpose is to confirm whether prevention and mitigation measures of secondary environmental pollution are effective or not or corresponding standards have been satisfied or not by means of monitoring over unorganized discharge to atmosphere and noise.

- **Exhaust gas**: check and verify the implementation of measures used for preventing the dust generated during the construction process of contaminated soil excavation, transportation and disposal (anaerobic biodegradation and phytoremediation), collect the samples of exhaust gas that is discharged to atmosphere arbitrarily inside pollution remediation area and check whether it has satisfied the atmospheric discharge standards or not according to atmospheric environment functions of Ganshui site and contaminated soil remediation area;
- **Noise**: conduct field investigation to verify the target position and quantity of sound environment affected by construction activities and supervise construction unit to prevent and deal with pollution source that may generate strong noise or vibration during the construction process according to design requirements;
- **Solid wastes**: verify the quantity of solid wastes generated during the construction process of contaminated soil excavation, transportation and disposal (plant corpus, construction waste, double-layer hermetic bag and soil after remediation) and supervise the proper and effective disposal of such wastes.
- **Ecological protection**: check and verify the implementation of ecological environment protection and restoration measures for land occupied by remediation site of contaminated soil according to environmental impact assessment requirements;

The main activities include: Daily patrol of whether water spraying to cut dust during the processes of site excavation, contaminated soil transport and soil remediation, whether the contaminated soil was covered; Daily patrol of whether the packaging process of contaminated soil is in line with the requirements, verification and record of the package numbers of contaminated soils; Irregularly patrol of contaminated soil transportation with vehicles to check whether the transport routes were the previously defined, to check whether implement the cleaning measures for the falling contaminated soils;

According to the implementation plan of remediation sub-project designed by contractor, regularly inspect whether the monitoring of atmospheric unorganized emissions and noises follows the requirements in the aspects such as location, quantity, sampling specifications and others;

(3) Supervision of environment management system

- Daily patrol of whether fulfill the personal protective plans and security warning labels;
- Check the implementation of emergency program specified (including the reserves of emergency substances), if necessary, to assist and supervise the contractor responsible for unexpected environment accidents and major environmental hidden dangers as well as protection measures for the population affected by it, record and place it on file;
- Supervise emergency training of environment risks;
- Make a weekly safety inspection of excavation and remediation projects joint with the contractors and construction supervision for the hidden safety risks;

(4) Acceptance of environmental supervision

Supervise whether sampling quantity, position and frequency during or after the foundation pit acceptance of site evacuation or remediation of contaminated soil have complied with national or local standards or not, or whether storage and submittal for inspection of samples are in line with relevant standards or not, to record the whole process.

(5) Supervision of Environmental Protection Facilities

According to remediation technology program and official documents approved by competent environmental protection management authority, environmental supervisors will daily patrol the configuration and operation of environmental protection facilities, and check the operation records.

Among the remediation programs of contaminated soil at Ganshui site, sewage treatment facilities are provided in program I while dust removal system at the end of cement kiln and shock absorption device for induced draft fan of dust catcher at the unloading area are specified in program II. The supervision of environmental protection facilities includes two aspects:

The first aspect is the deployment supervision of environmental protection facilities. It is necessary to check and supervise whether the construction site has been equipped with the environmental protection facilities required by the design documents, and whether all environmental protection facilities are of the conditions for normal operations. The supervision flowchart is detailed in Figure 32.

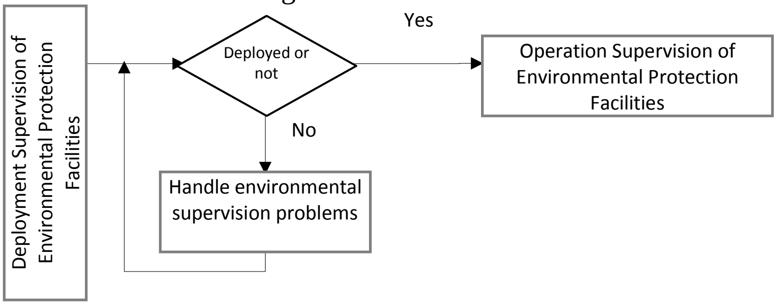


Figure 32 Deployment Supervision of Environmental Protection Facilities

The second aspect is the operation supervision of environmental protection facilities. It is necessary to check and supervise whether the operation of the environmental protection facilities has satisfied the design performance, and whether they have met the relevant environmental standards. The supervision flowchart is detailed in Figure 33.

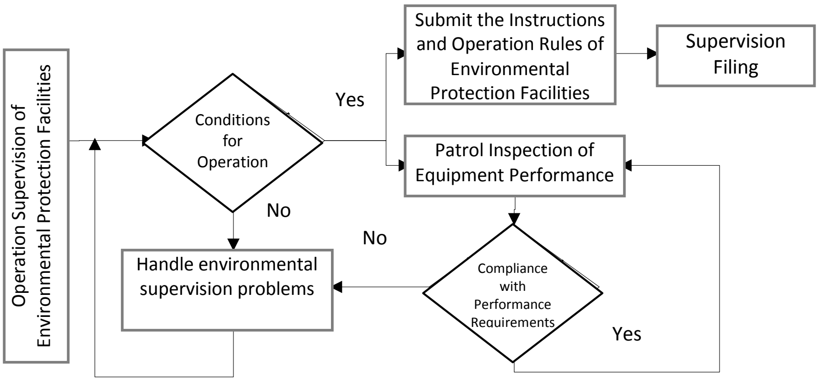


Figure 33 Operation Supervision of Environmental Protection Facilities

(6) Environmental Supervision Report

- Prepare the semi-annual reports, annual reports and special reports of environmental supervision; ☐
- Environmental supervision engineer and the Employer's representatives will organize contractor and representatives of designers responsible for site assessment and remediation program to check and review the engineering site and materials and discuss whether to pass the preliminary inspection or not, and provide the Employer with preliminary inspection report on engineering environment.
- Environmental improvement report: if it is found by the environment supervisors during the inspection process that there exist environmental pollution issues or it fails to comply with remediation construction program or reach the national (or local) standards concerning pollutant discharge, the environment supervisors shall notify the responsible person of the contractor at site immediately to make improvement. The common or operational issues shall be notified orally or the environmental supervision department shall issue the Business Contact Sheet of Environmental Supervision for these issues; If the rectification becomes invalid or there exists the major pollution hidden trouble, the supervisors shall report these conditions to the chief engineer of environmental supervision, who shall issue the Rectification Notice of Environmental Supervision.
- Special cases, such as hidden dangers of environmental risks, shall be reported in a timely manner upon being found.

7.8.4. Monitoring of Environmental Impact

In order to fully and timely master the impact of the remediation project on the regional environmental quality, the sensitive points with more obvious contamination are taken as the monitoring points, and it is necessary to monitor the impact of fugitive dust, noise and contaminant spread during the excavation and remediation process on the environmental sensitive areas and surrounding environment according to the defined remediation technology program and in combination with the environmental situation of the site. The specific monitoring plan is detailed in Table 45.

Table 45 Environment Monitoring Plan of Ganshui Site Remediation

Environment Element	Monitoring Position	Monitor Indicator	Monitor Frequency	Implemented by	Execution Standard or Specification
Air	Set up contrast point in upwind of Ganshui site	Suspended Particles (Arsenic, α-BHC and β-BHC)	At the time of starting or finishing excavation at Ganshui site respectively	Independent third party institution	Technical Guidelines for Fugitive Emission Monitoring of Air Pollutants (HJ/T 55), Monitoring and Analytical Method for Ambient Air and Exhaust Gas (China Environmental Science Press, 2003, the fourth edition), Sampling and Analysis of Air Stationary Sources (China Environmental Science Press, 1993)
	Main sensitive point within 500m out of site boundary in the downwind of Ganshui site				
	Vent of storage site of contaminated soil of Chongqing Lafarge Cement Plant		Monitoring at remediation demonstration site every two months		
	Set up contrast point in upwind of remediation demonstration site				
	Main sensitive points within 500m out of site boundary in the downwind of the remediation demonstration site				
	Flue gas discharge vent of cement kiln chimney (If scheme 2 was adopted)	NOx, Sox, HCl, dioxin, F and compounds, Hg, Cd and compounds, Σ(As, Ni and compounds), PM,Σ(Cr, Sn, Sb, Cu, Mn and compounds)			Cement industry air pollutants emission standards of China (GB 4915-2013)
Surface water	Section of Ganshui River in the north of Ganshui site	Arsenic, α-BHC and β-BHC	Sampling for monitoring at the time of starting or completing excavation at the cross section of Ganshui River respectively	Independent third party institution	The wastewater produced during the construction period may not be drained into the class-I and class-II waters prescribed in Environmental Quality Standards for Surface Water (GT3838-2002) If it is drained into other waters, it must comply with the corresponding water quality standards. Technical Specifications Requirements for Monitoring of Surface Water and Waste Water (HJ/T91-2002), Environmental Quality Standards for Surface Water (GT3838-2002)
Noise	Set up the reference points in the areas without industries, business and residents, and far away from Ganshui site	Noise	Measure noise at the surrounding reference points and monitoring	Independent third party institution	The field boundary noise during the construction period is 70dB in day time and 50dB in night time.

	Set up noise monitoring points in the sensitive areas around Ganshui site		points of Ganshui site on a daily basis during the excavation construction process (9 PM and 12 noon); average sound level for 5 min at measurement area each time		
	Set up the reference points in the areas without industries, business and residents, and far away from the remediation demonstration site		Measure noise at the surrounding reference points and monitoring points of remediation demonstration site on a monthly basis (9 PM and 12 noon); average sound level for 5 min at measurement area each time		Standard of Environmental Noise of Urban Area (GB30 96-93) and Emission Standard of Environment Noise for Boundary of Construction site (GB12523 -2011)
	Set up noise monitoring points in the sensitive areas around the remediation demonstration site				

7.8.5. Environmental Supervision Documents

The environmental supervision forms (sheets) shall be developed in accordance with the recommended format of Circular on Further Promotion of Environmental Supervision Pilot Work of Construction Project, MEP (Environmental Protection Office Document No. 5 (2012)), with more details in the List of Environmental Supervision (Table 46).

Table 46 List of Environmental Supervision

(I) Environmental Supervision Form	
1	Environmental Supervision Log
2	Work Contact Sheet of Environmental Supervision (send to the remediation contractor)
3	Rectification Notice of Environmental Supervision
4	Report Form of Major Environmental Problems
5	Reworking Notices/Suspension Notices/Return-to-work Notices of Environmental Supervision
6	Report Form for Environmental Pollution/Ecological Destruction Accidents
7	Report Form for Rectification and Restoration of Temporary Land Use
8	Validation Record of Environmental Protection Project
(II) Environmental Supervision Report	
9	Environmental Supervision Program
10	Minutes of Regular Supervision Meetings
11	Environmental Supervision Semiannual Work Report
12	Environmental Supervision General Report

7.9. Site Remediation Validation

Site remediation validation includes two parts: contaminated soil excavation validation and contaminated soil treatment validation, which is conducted according to the site remediation validation program approved by the Chongqing environmental protection departmen.

7.9.1. Contaminated Soil Excavation Validation

The purpose of excavation quality validation at Ganshui site is to confirm the accuracy of excavation boundary and earth volume and its detailed process is shown in Figure 34, including such basic operational units as pre-measurement, earth excavation, intermediate inspection and post inspection.

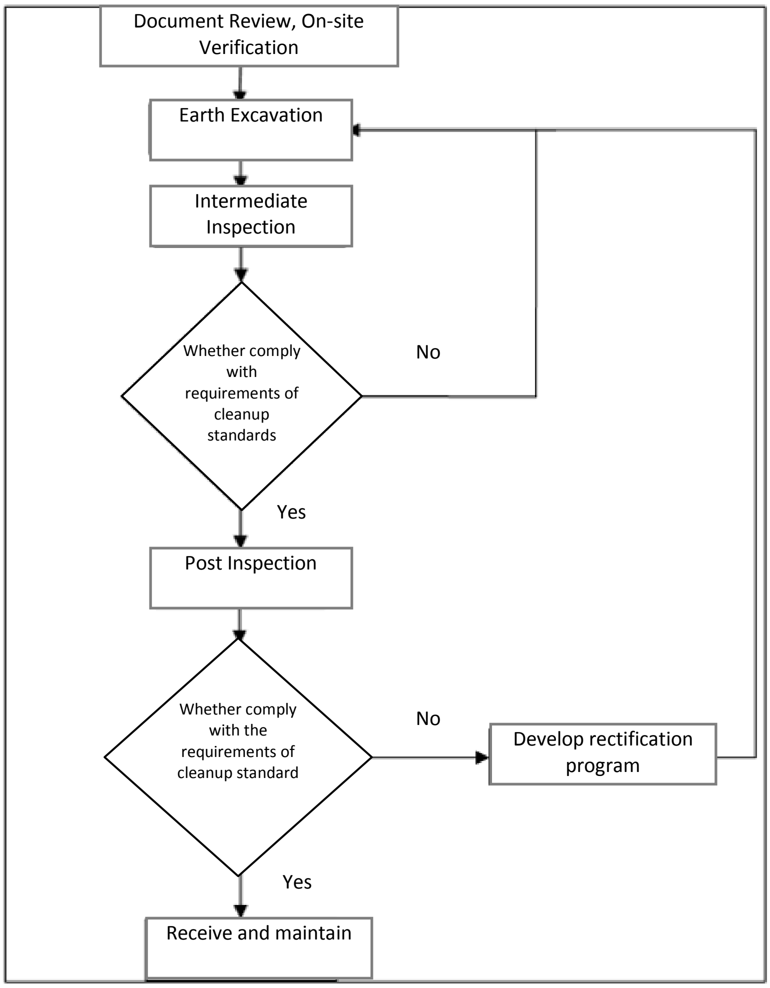


Figure 34 Internal Quality Control Flowchart of Excavation Process

(1) Excavation: the sampling of earth pit is classified into collection of bottom sample of the earth pit and the collection boundary sample (pit wall) of the earth pit. The soil sampler is used to collect the soil in the depth scope of 0.2 m at pit bottom. The soil is taken as the soil samples after they are evenly mixed. The soil sampler is used to collect the soil in the depth scope of 0.1 m on the pit wall with regard to the sampling of pit boundary (pit wall). The record, preservation, test and analysis of soil samples shall comply with the relevant national provisions.

The sampling density during the validation process is detailed in Table 47.

(2) Pre-measurement: it means conducting further verification and measurement and making a mark at critical sites based on the earth excavation scope given in the risk assessment report.

(3) Post-inspection: it means the internal validation of earth excavation scope, including the inspection of earth excavation records and spot test of soil samples based on percentage of 5% for analysis and detection; if concentration of target pollutant is greater than limiting value of remediation target, it is needed to notify the Employer and require the contractor responsible for remediation to expand the excavation scope; if concentration of target pollutant in the soil is less than limiting value of remediation target, it is deemed that requirement about excavation boundary has been met; in addition, it is also required to inspect and measure the geometric dimensioning of pit during the post-inspection process. When compared with specified dimension, error of plan view size and pit depth shall not exceed 0.5 m and 0.2 m respectively.

Table 47 Sampling at the Bottom and Wall of the Earth Pit

Condition of Earth Pit	Sampling Density of Pit Bottom
The pit bottom area of the earth pit of contaminated soil shall be less than or equal to 1000 m^2.	Take 2 soil samples.
The depth of earth pit of contaminated soil is less than or equal to 3 m.	Take one sample every 20m along the boundary of pit wall (if perimeter of pit boundary is less than 20m, calculation will be done based on 20m perimeter); take one sample at the interval of 0.5m along the depth direction of pit. Mix all the samples collected evenly and make them into one sample of pit boundary (or pit wall).

7.9.2. Contaminated Soil Treatment Validation

7.9.2.1. Process for Contaminated Soil Treatment Validation

The validation program is developed according to the risk assessment and remediation program of contaminated site, remediation project design, remediation supervision report, disposal condition of "three wastes"(waste water, waste gas and solid waste), remediated soil test, secondary pollution accident and environmental protection complaints and other materials. The validation working procedure for remediation of contaminated site is shown in Figure 34.

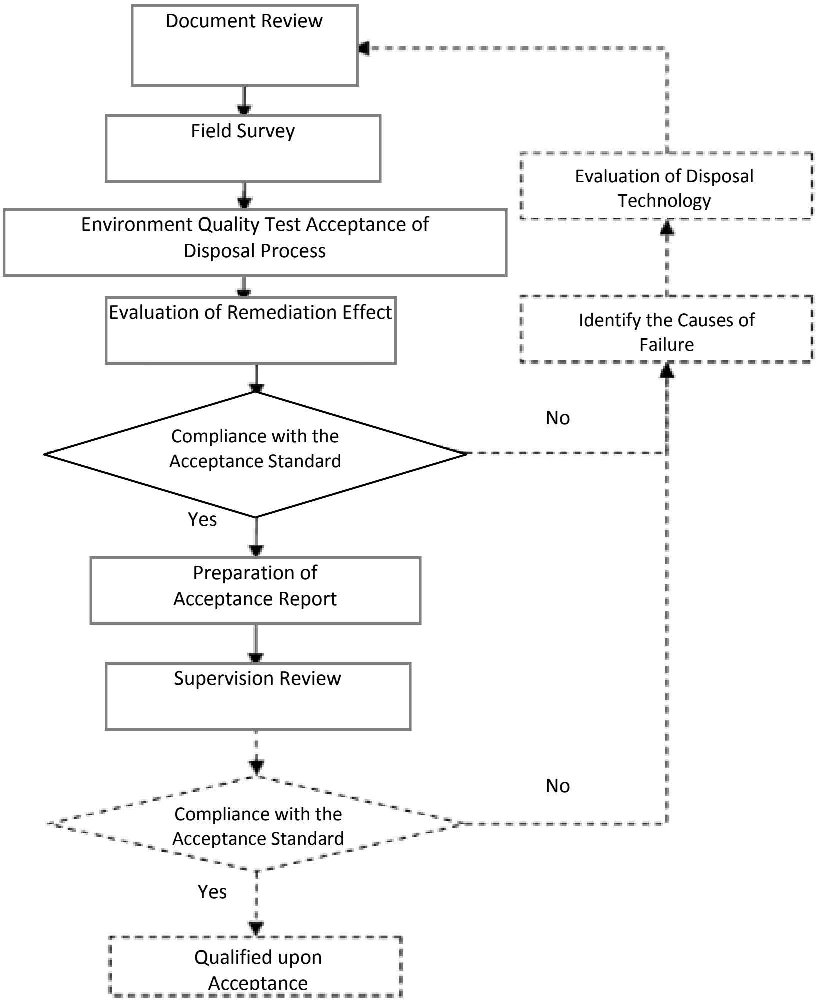


Figure 35 Validation Procedure for Disposal Process of Contaminated Soil

7.9.2.2. Main Validation Contents

(1) Document Review

Verify the implementation situation of remediation program of contaminated site by reviewing the relevant record documents. The verification contents mainly include record list of classified disposal of contaminated soil, remediation ways, final disposal of contaminated soil, pollution prevention and control measures and effect during the remediation process, and so on. The specific materials are detailed in the List of Validation Materials (Table 48).

Table 48 List of Materials Applied for Validation

No.	Name of Materials for Approval	Remarks
1	Excavation and transport record of contaminated soil, correspondences, transport record of backfill, etc.	Contractor
2	Contract and related documents concluded by the contractor and the Employer regarding the remediation of contaminated site	Contractor
3	Site remediation supervision report	Supervisor
4	Photo and image materials concerning site remediation	Contractor
5	Test report of remediated soil samples	Contractor
6	Completion report of remediation project	Contractor

(2) Field Survey

Survey the remediation site in combination with the implementation condition of site pollution remediation program, and check the standardization in disposal process of contaminated soil.

(3) Evaluation of Remediation Effect

Target at up-to-standard conditions of soil after remediation, evaluation of remediation effect is mainly to confirm that it has reached remediation target value (0.2 mg/kgα-BHC, 0.22 mg/kg β-BHC and 20 mg/kg arsenic). Sampling plan for the disposal of contaminated soil by phytoremediation and anaerobic biodegradation is as follows:

- Sampling density for the validation of phytoremediation of contaminated soil is 10 pieces/100 m^2;
- Validation sampling for the disposal of contaminated soil by anaerobic biodegradation: draw water at the upper layer of anaerobic pond, excavate the soil at the lower layer and take 2 samples for each anaerobic biodegradation pond;
- Validation for the co-disposal of contaminated soil at cement kiln: as contaminated soil is viewed as raw materials for the production of cement, it is impossible to collect soil samples for validation. Its validation is mainly to confirm whether cement produced has reached the standards or not, or contents of dioxin and arsenic in the cement samples have exceeded the contents specified by validation standards of cement industry or not.

(4) Preparation of Validation Report

Summarize the remediation program, survey findings, test data, statistical analysis and validation evaluation results, and prepare the remediation validation report of contaminated site.

(5) Supervision Review

Chongqing Environmental Protection Bureau (agent owner) shall organize the experts to review the environmental remediation validation reports of Ganshui site after preparing the validation reports.

7.10. Implementation of environmental management plan

7.10.1. Evaluation of Environmental Management Plan

(1) Evaluation before Project Implementation

After the approval of environmental assessment report of remediation sub-project at Ganshui site by the World Bank and one week prior to the implementation of specific project, Chongqing project office will arrange the preparation and assessment of environment management plan about remediation of Ganshui site. It is mainly aimed at assessing whether existing environment management plan can meet the requirements of laws and regulations in relation to environment, occupational health and safety or satisfy the requirements about green remediation of contaminated soil at Ganshui site or not.

(2) **Evaluation of Project Implementation Process**

The contractor, the supervisors (including environment supervisor and engineering supervisor) and the Employer (Chongqing project office) shall assess and evaluate the implementation conditions of remediation sub-projects at Ganshui site at each stage (contaminated soil excavation at site and annual summary about implementation of remediation project) as well as environment management plan and propose rectification measures.

(3) Evaluation Method

The method of internal evaluation is mainly adopted for environment management plan and Chongqing project office shall be responsible for arranging and organizing departments involved in the implementation of environment management plan (the contractor and the supervisor) to analyze existing problems and assess implementation effects jointly by reporting and discussing implementation of environment management plan. In order to guarantee the traceability of the evaluation process, it is necessary to form the complete evaluation reports or evaluation records.

(4) Evaluation Content

The evaluation contents of the environmental management plan shall include, but not limited to, the following aspects: staffing condition of the Employer and the Contractor, various preventive measures and mitigation measures taken during the construction period and operation period, the environmental impact from the project construction, execution condition and effect of environmental management plan training, environmental monitoring data during the construction period and operation period, environment nuisance events and handling condition, social supervision condition, etc.

7.10.2. Information Management of Environmental Management Plan

7.10.2.1. Information Exchange

It is required that the necessary information exchanges shall be carried out among different departments and posts in the organization, and the organization shall also announce the relevant information to the outside (the interested party, the society, the public, etc.)

The internal information exchanges can be made by ways of meetings, internal briefing, etc., however, the official meetings must be held once a month, and all exchanged information shall be recorded and archived.

The external information exchanges shall be made once every six months or once a year, and the information exchanges with the collaboration units shall form the minutes of meeting and be archived.

7.10.2.2. Recording Mechanism

In order to ensure the effective operation of the environmental management system, the organization must establish a perfect recording system and remain the following records:

(1) Requirements of laws and regulations;

(2) Permits for various operation links of the project issued by the governmental management organization;

(3) Environment factors and relevant environmental impacts;

(4) Training organized by relevant units within the management framework of remediation sub-projects at Ganshui site

(5) Inspection, review and maintenance activities;

(6) Monitoring data;

(7) Effectiveness of corrective and preventive measures;

(8) Information of the Employer, the Contractor, the third party supervisor, validation organization, and other interested parties;

(9) Audit records;

(10) Remediation Sub-projects Review in Ganshui site at Various Stages

7.10.2.3. Reporting Mechanism

The contractors, monitoring units and the Chongqing project management unit shall record the project progress condition, the execution condition of the environmental management plan (EMP), the environmental quality monitoring results and other matters during the implementation process of the project and report them to the related departments. Mainly including the following contents:

(1) The monitoring unit and the contractor shall record in detail the execution condition of the EMP and report it to the project management unit.

(2) The project progress reports prepared by the project management unit (including monthly reports, quarterly reports, annual reports, etc.) must contain the content of EMP progress, such as execution progress and effect of the EMP, etc.

7.10.3. System of Safeguards of Environment Management Plan

7.10.3.1. Relevant Rules and Regulations

In addition, to establish and perfect the rules and regulations is very important to safeguard the health and safety management. The relevant rules and regulations mainly include the following contents:

(1) Regular routine work system: including regular meetings, periodic training course, periodic inspection of relevant work, etc.

(2) Management System of Related Expenses: make clear the source and usage of the expenses.

(3) Management system of major hazard sources: it is necessary to register and archive, periodically test, evaluate and monitor the major hazard sources, and develop the corresponding emergency response plan, and register with local work safety supervision management department and other departments for record.

(4) Fire protection and traffic safety management system: determine relevant matters, such as fire-fighting equipment, fire-fighting inspection and fire drill, define the rules concerning safe use of vehicle as well as other matters in relation to learning, training and assessment of drivers.

(5) Education and training system: make clear the training objects, contents, time and assessment criteria, and other matters; the training contents include the training of related knowledge for the managers; induction training for new employees, rotation training of original staff, operation training of new materials, new technology and new equipment, the training of special operators, emergency training, and so on.

(6) Delivery, use and management system of PPEs: make clear the type, application scope, withdrawal procedures, pre-use inspection, operation supervision, and after-use maintenance, service life and other matters of the PPEs.

(7) Safety regulations on posts: the other operation posts shall comply with the general safety requirements apart from the special operation posts.

(8) Safety operation manuals: the safety operation manuals of various equipment related to human health and safety.

(9) Occupational health examination system: related requirements on regular health examinations.

(10) Management system of associated marks: Define the billboard for managers, billboard for fire control and security, billboard for access system, billboard for work safety, billboard for civilized construction, safety placards and safety warning signs and general construction layout (drawing).

(11) Management system of operating environment: make clear the supervision and management of passages (accesses), lighting and ventilation situation of the site;

(12) Management system of contractors: it is necessary to review the relevant qualification of the contractors, make clear the safety responsibility of various parties, sign the HSE management agreement, make clear the safeguard measures to be taken by both parties, and make clear the inspection and coordination way of site work.

(13) Reward and punishment system: implement the principle and reward and punishment form of HSE management reward and punishment system.

(14) Emergency management system: make clear the department for emergency management, the related matters of emergency response plan, etc.

(15) Accident investigation reporting system: define the internal investigation reporting procedures of accidents and process for reporting to relevant competent department.

7.10.3.2. Fund Arrangement

(1) Fund Sources

Remediation fund of sub-projects at Ganshui site comes from two sources: grant of the World Bank and self-raised funds of Chongqing municipality. Among these, use of granted funds for procurement shall be in line with relevant provisions of the World Bank.

(2) Funds Uses

Implementation of remediation sub-projects at Ganshui site, especially the prevention and mitigation measures of secondary environmental pollution, requires sufficient fund guarantee and its use of funds mainly cover the following contents:

- Construction costs required for excavation of Ganshui site, transportation and temporary storage of contaminated soil, phytoremediation of contaminated soil and anaerobic bioremediation;
- Budget of environmental monitoring expenses before, during or at the later stage of remediation;
- The project implementation and management fee budget of prevention and mitigation measure of secondary environment pollution;
- Staff training cost budget;
- Relevant administrative cost budget.

7.10.3.3. Education and Training

The environmental management plan (EMP) is an important part of site remediation. In order to ensure the successful and effective implementation of the EMP, especially the prevention and mitigation measures of secondary environmental pollution, it is necessary to offer the EMP and related knowledge and skill trainings to the work staff of the Employer, the operation unit, the contractor and project supervisor, and the interested parties. During the training process, it is necessary to offer different trainings to different posts.

It is necessary to develop the training program before the training activities, and the training program shall contain the training purpose, trainees, training contents and methods, training assessment and continuation, training time and place, trainers, source of training fund and other contents. Among them, the training contents shall include, but not limited to:

- Environmental and social security policies of the World Bank; ☐
- China's laws, regulations and policies of environmental protection and land administration; ☐
- The environment management mode of loan project of the World Bank and the environment terms in the loan agreements;
- Site environmental assessment method and technical requirements; ☐
- Remediation technology and pollution control technology; ☐
- The environmental/social impact and mitigation measures in the EMP; ☐
- The environmental supervision methods and technical requirements; ☐
- The environmental monitoring technology; ☐
- Remediation validation methods and technical requirements; ☐
- The responsibilities and correlation of management unit, supervision unit, remediation validation unit and contractors, etc. ☐
- Preparation of the environmental management work report, environmental supervision work report, contractor's monthly report of the remediation project, etc. ☐
- The environmental risk and emergency measures during the remediation process; ☐
- Common sense and health safety requirements of the constructors.

The training program developed in light of the remediation sub-projects in Ganshui site is detailed in Table 49.

Table 49 Training Schedule of Remediation Subproject

Training Topic	Trainee	Training Content	Training Time
Environmental policies and laws and regulations	• Competent environmental protection management authorities at all levels • Project management departments	Environmental protection laws, regulations and policies in China Land management laws, regulations and policies in China Environmental and social security policies of the World Bank;	1/2 day
Site environment assessment	• Competent environmental protection management authorities at all levels • Project management departments • Site evaluators • Owner of the project	Identification content and technical requirements of site pollution Site sampling methods and technical requirements Site risk assessment methods Preparation of reports	1/2 day
Site remediation technology	• Competent environmental protection management authorities at all levels • Project management department • Owner of the project • Contractor • Supervision Unit	Site remediation technology Pollution control technology Preparation of remediation program	1/2 day
Environmental management plan	• Competent environmental protection management authorities at all levels • Project management departments • The owner of the project • Contractor • Supervision Unit • Validation Unit	Main contents and tasks of the EMP Mitigation measure of secondary pollution Environmental supervision work content, method and system Site validation content and method Environmental monitoring method Data acquisition and processing Collation and preservation of monitoring data, information exchange and record, report system	Every two days

Emergency Treatment	• Owner of the project • Contractor • Constructors	Environmental risk of remediation project Emergency management measures	1/2 day
Constructors protection	• Contractor • Constructors	Environmental common sense of the constructors Health and safety protection of the constructors	1/2 day

7.10.4. Execution Report of Environmental Management Plan

During the implementation process of the environmental management plan, the project management unit shall prepare and submit the execution and progress reports for the important aspects, and the reports usually include the following contents:

(1) From Contractor: It is necessary to record in detail the execution condition of environmental management plan and measures in the reports and submit in time the reports to the Employer;

(2) From Environmental Monitoring Unit: The environmental monitoring unit shall be authorized to carry out the monitoring activities in light of the monitoring plan, and briefly explain the resulting data and whether it is up to standard or not, indicate the existing problems and substandard phenomenon, and analyze its causes and propose the suggestions of rectification measures;

(3) From supervision unit: The supervision unit shall submit the supervision Periodical Report and final report in terms of the requirements of engineering supervision specifications, and the reports must cover the chapters containing the execution condition of environmental management plan.

(4) From Project office of Chongqing:

i. Annual Implementation Plan: Chongqing project office shall, before September 30 every year, submit the implementation plan of Ganshui site remediation sub-projects of the next year to Foreign Economic Cooperation Office, Ministry of Environmental Protection of the People’s Republic of China based on project requirements and its contents shall include specific implementation contents of the next year, budget of fund demands and summary of experiences and lessons achieved during the implementation process of the project this year;

ii. Annual interim financial report: Chongqing project office shall, based on project requirements, submit un-audited and semi-annual financial report on Ganshui site remediation sub-projects no later than the mid-July every year;

iii. Project concluding report: Chongqing project office shall complete project conclusive report within the specified period.

(5) From FECO

Foreign Economic Cooperation Office, Ministry of Environmental Protection of the People’s Republic of China (FECO) shall, on February 15 and August 15 every year, submit the report on the implementation progress of Ganshui site remediation sub-projects according to the requirements of the World Bank.

(6) From independent financial auditing company

Independent financial auditing company is entrusted by Foreign Economic Cooperation Office, Ministry of Environmental Protection of the People’s Republic of China to conduct annual financial auditing over Ganshui site remediation sub-projects and audit report shall be submitted to the World Bank before July 1 every year.

7.11. Public Consultation Plan at Implementation Stage

Public consultation plan at the implementation stage of Ganshui site projects mainly includes the following contents:

(1) During the process of project implementation, conduct questionnaire survey or random interview (for one time), check to see whether environmental mitigation measures have been implemented well during the implementation process (site clearing, transportation, temporary storage and remediation of contaminated soil), know about the opinions and suggestions of surrounding residents during the project implementation process and answer the questions of the public;

(2) Publicize the bidding and tendering and validation of projects (for twice) and disclose the important information during the implementation process of projects;

(3) Conduct internal technology and management exchange meeting (unlimited), report project progress conditions, solve project problems, answer and feedback doubts and complaints raised by residents;

(4) During the implementation process of projects, coordinate with Chongqing Municipality to conduct door-to-door interviews, broadcast advertising video, distribute brochure and hold knowledge lectures purposely and as scheduled for overall planning of contaminated site (unlimited);

(5) Build perfect appeal mechanism.

7.11.1. Random Interviews

One questionnaire and random interview shall be carried out during the implementation of the project, and the main contents and objects are as follows:

- Interview persons passing through the site during the implementation of the project; the main interview contents include: whether or not the implementation of the project has blocked the road, whether there is serious noise, whether there is serious dust and odor, whether there are obvious fences and warning signs, etc.
- Interview residents along the transport route during the transport of contaminated soil; the main interview contents include: whether or not the transport vehicles have caused serious noise, whether there is spilled soil and sewage, whether they cause the traffic jam, whether they pass through the route at rush hours, whether there are serious dust and odor, whether there are protective measures and rainproof measures, etc.
- Interview staff on temporary stockyard of contaminated soil; the main interview contents include: whether or not they understand the contaminants contained in the temporarily stored soil and their hazard, whether the protective measures of temporary stockyard for contaminated soil have satisfied the requirements, whether they understand the earthwork volume of contaminated soil for temporary storage, etc.
- Interview surrounding affected residents during demolition and dredging construction; the main interview contents include: check whether or not the environmental mitigation measures are executed in place (whether noise, sewage and fugitive dust have polluted the surrounding environment, affecting the residents' health), understand whether the residents have the questions, complaints and feedback information for the site remediation, whether the loss of properties are caused, etc.
- Interview surrounding residents during the implementation of remediation demonstration project of contaminated soil; the main interview contents include: whether or not the environmental impact assessment was made to the site of contaminated soil, whether they understand the usage of the site, whether they understand the possibly caused environmental impact, whether the project has exerted the impact on their lives and livelihood, etc.

7.11.2. Project Disclosure

During the implementation of the project, the disclosure of key information of the project shall be made to the public to accept the supervision and questioning of the masses, and it mainly includes the disclosure of the following aspects:

Disclosure I: Including the disclosure of bidding and tendering information and bid winning results of projects. It is necessary to publish information on the website of Chongqing Environmental Protection Bureau and local newspaper and post the information public announcement at the surrounding bulletin boards of project site (contents of site remediation projects disclosed shall include project contents, main measures, emergency response measures, contact person responsible for handling complaint and its contact information).

Disclosure II: Mainly referring to monitoring and validation results after completing the project, and review comments of the related governmental departments, and other information (including the project contents, main measures, emergency response measures, complaints contact and methods, etc.), which shall be disclosed on the website of Chongqing Environmental Protection Bureau and published in local newspapers, and pasted in the surrounding billboards of the site.

7.11.3. Workshop/Seminar

The project workshop or seminar mainly refers to the international technology and management seminars whose main functions are to enable the Employer, project management departments, government functional departments, project supervision units, project contractors and technical consulting units to mutually understand the progress condition of the project and determine the solutions and feedback opinions according to the complaints of surrounding residents.

7.11.4. Other Participation Ways

In consideration of scale of Ganshui site, quantity of surrounding population affected by it, degree of understanding of affected population about environmental protection knowledge, targeted at features of POPs contaminated site and by combining with overall planning of Chongqing Municipality about contaminated site, Chongqing project office proposes to implement participation methods acceptable to the public, such as door-to-door interview, broadcasting of advertising video, brochure distribution and holding of knowledge lectures at the links of wall peeling on the surface layer of site building, contaminated soil excavation, transportation, storage and remediation treatment of Ganshui site remediation sub-projects.

7.11.5. Complaint Mechanism

In order to maintain the environmental quality situation and the interests of local villagers, a convenient, open and effective complaint mechanism shall be established for this project, and the affected people can file the complaints for any problem in the EMP.

(1) Accepting Agency for Complaints

The Project office of Chongqing shall designate the person specially for complaint issue of the villagers, and open the complaining telephones to the public and accept the consulting and complaining businesses of the public. Contact Person: Lu Hailin, Mobile: 18523805126, Email: Ganshuichangdi@163.com.

(2) Complaining Procedures

Phase I: If residents at the surrounding area of Ganshui site have any doubt over the specific contents of environment management plan, or local environment quality and order of social life is affected by construction process of Ganshui site remediation sub-projects, residents may file complaints to Chongqing project office orally or in writing and Chongqing project office shall, within two (2) weeks after the receipt of such complaints, respond to or deal with feedback opinions.

Phase II: If the complainant is still unsatisfied with the handling decision of the project management unit, he or she can file the complaint to the related provincial authorities after receiving the decision.

(3) Feedback Mechanism of Complaints

The feedback mechanism of complaints includes standardized recording, tracking and regular reporting system.

- Standardized Recording: the record form of complaints mainly contains: basic information of the complainant, basic information of the complaint, basic information of the replier, solution and achieved effect. ☐
- Tracking: the return visit of the complainant is made to determine whether the complaining event has been handled, and whether the complaint is satisfied with the handling result. ☐
- Regular Reporting: the problems complained shall be regularly reported in writing to the superior management office and prepared into the plan of the next year to avoid the occurrence of similar events. ☐

8. Public Consultation in Site Environmental Assessment

8.1. Legal Basis

Since there is no guidelines of public participation in remediation projects (not yet taken as construction projects for the time being) of contaminated sites issued in China, the legal basis for public participation in this Project mainly refers to the relevant technical requirements for public participation in environmental impact assessment laws for construction projects as shown below:

(1) In accordance with the Law of the People's Republic of China on Environmental Impact Assessment (EIA Law)" (September 1, 2003), Article 21 stipulates that "With exception of confidential circumstances as specified by the State, for construction projects that might cause significant impact on the environment and need the environmental impact report, the construction unit shall hold on-site meeting or hearing, or solicit related units, experts and the public by other means for comments before submitting the environmental impact report for approval. The environmental impact report submitted by the construction unit for approval shall be complete with an explanation on whether or not to adopt the comments of related units, experts and the public."

(2) In accordance with Regulations on the Administration of Construction Project Environmental Protection (Decree No. 253 of the State Council of the People's Republic of China, November 29, 1998), Article 15 states that "Construction units should, in compiling the environmental impact reports, solicit the views of the units and residents concerned of the locality wherein the construction project is located pursuant to relevant provisions of law."

(3) In accordance with the Interim Regulations on Soil Environmental Management of Contaminated Sites (Draft for Public Comments), Article 23 (Notice of Completion of Remediation Project) states that "Land users of contaminated sites should issue the notice of completion of contaminated site control and remediation project timely after such project comes to an end".

8.2. Public Consultation and Information Disclosure

8.2.1. Public Consultation

According to the relevant regulations of the World Bank, it is required to make an investigation and consultation to the public affected directly or indirectly to solicit their opinions and requirements for project implementation. Therefore, public participation is the important mechanism for the mutual communication among Chongqing Project Office, remediation contract and the public affected, and it is crucial for the project decision-making and the successful implementation of remediation, achieving the following purposes:

a) To help the public within the affected region, especially those around Ganshui Site, immediately get informed of the basic information, including site contamination, potential environmental impact, technically remedying measures and the secondary environmental contamination-fighting measures.

b) To help the public express their opinions and views of the remediation project of Ganshui Site through normal channels, and learn major concerns.

c) To allow the public to help identify potential environmental problems during remediation so that sound actions can be taken to protect potential targets.

d) To enhance the public's receptivity of EIA, ensure the feasibility and rationality of environmental protection measures, and finally improve site remediation design and implementation management.

e) To contribute to the implementation of relevant environmental protection measures during the public supervision and remediation.

f) To make the public fully understand the favorable side of remedying Ganshui Site, improve their living environment, and protect the health so as to obtain the support for project implementation.

Public consultation was carried out mainly at two stages: site screening (identification of contamination) and site investigation (confirmation of contamination).

(1) Public consultation at stage 1 - identification of contamination

I Site exploration

Site exploration includes geographic location, site layout, pollution discharge, environmental permit, monitoring report, hydrology, pollution/hazardous chemicals, hazardous waste, tank, use of PCB, wastewater treatment, exhaust gas treatment, environment, safety and health, environmental accidents, environmental complaints and water use, etc. Findings show that the warehouse of Ganshui Supply and Marketing Cooperative is located in the south of Qijiang District, Chongqing , at 106º42′11.53″ E and 28º44′57.22″ N. The site was originally put into use for storing pesticides around 1960. Therefore there was no environmental approval, monitoring report, hydrological investigation, wastewater treatment, exhaust gas treatment, environment, safety and health, environmental accidents, environmental complaints; there might be soil contamination caused by pesticide spill or breaking.

II Investigation of site proprietor and use:

The proprietor of Ganshui Site is Ganshui Supply and Marketing Company. From the 1960s to the end of 1990s, the warehouse of Ganshui, as the materials storage warehouse of pesticide, fertilizer, seed and farm tools, etc., has been rented during 2002 and 2012, and in the languish state since 2012.

III Public investigation:

The site investigation group visited part of staff of the pesticide warehouse and nearby residents, inquiring them about site contamination and impact thereof upon the nearby area. Time: November 2012 (Annex 15 - First public questionnaires on Ganshui site). On-the-site respondents said the site environment was good. Three respondents (2 females and 1 male), aged between 30 and 40. Results are as below:

- 1 person said the site has been used for pesticide storage;
- 2 persons thought no environmental pollution had been caused to the surroundings of the site, and 1 person said he/she was unclear;

- All the 3 persons said no pollution accident had occurred at the site;
- All the 3 persons said the region around the site were suitable for living;
- All the 3 persons agreed relocation of the site;

According to site survey and investigation, there was no area inhabited by ethnic minorities around Ganshui Warehouse, and the income sources of surrounding residents was irrelevant to Agricultural Material Warehouse.

(2) Public consultation at stage 2 - confirmation of contamination

On basis of the identification of samples of site contamination, it was made clear that the site was contaminated by pesticides like POPs. At stage 2, confirmation of contamination was conducted in March 2014, with nearby residents as respondents to learn their knowledge of site contamination (see the summary below). For details, see Table 50 and Annex 16 - Second Public Questionnaires on Ganshui Site:

Table 50 Questionnaires at Phase II Site Investigation

Gender of respondent		Age of respondent			
Distance between living place and the survey target	<200m	200-500m		>500m	
Familiarity with the survey target	Not know	General		Very familiar	
Know the usage of site or not	Yes		No		
Know POPs or not	Not heard yet	No		Have heard, but not know it well	
Know that the organo-chlorine pesticides belong to POPs or not	Yes		No		
The target site is harmful or not	Yes	No		No	
Cancer incidence of the surrounding residents	High	Low		No	
Spread means of hazards	Air	Rainwater	Soil		Others
Smelt the odor of pesticide or not	Yes		No		
Used groundwater or not	Yes		No		
Know the government’s decision on relocation of the site or not	Yes		No		
Agree relocation or not	Yes		No		

50 persons participated in the survey, of which, 24 are male and 26 are female. 19 are below 40 years old, 22 are between 40 to 60 years old, and 9 are over 60 years old.

- 60% of the respondents knew the history and usage of the site;
- Only 9 have heard POPs, most of them didn’t know POPs;
- Only 4 (8%) thought that the site was hazardous, and most of them didn’t know whether the site was hazardous or not;
- 29 (58%) thought that the cancer incidence of surrounding residents was low, and the others didn’t know it;
- 17 (34%) thought the spread way of hazards was rainwater, and 33 thought the spread way of hazards was air;
- 20% of the respondents have smelt the odor of pesticide around the site;
- 45 (90%) respondents didn’t use groundwater in daily life;
- 30 (60%) respondents knew the government’s decision on relocation of the site;
- 43 (86%) respondents agreed the government’s decision on relocation of the site.

(3) Survey among the residents directly influenced by site remediation

According to site exploration results, the directly affected residents were the warehouse keeper and his wife. A household survey of the couple has been planned to carry out in terms of "family size, age, source of income, health, period of residence, whether they know the site contamination, whether they know the site remediation is about to be carried out, whether they are clear about the possible impact that remediation may produce upon them, what requests they have about the impact that site remediation may produce upon them involved".

On July 13, 2014, the working personnel of Chongqing Project Office (Lu Hailin), consultant experts of Beijing Academy of Environmental Sciences (Wang Shijie, Zhong Maosheng), participant of Chongqing Solid Waste Management Service Center (Zhu Xiaolong) and the person in charge of Ganshui Supply and Marketing Cooperative (Li Jiang) consulted with a directly affected household (the couple).

Firstly, introducing the background of remediation subproject of Ganshui Site and its environmental significance in implementation, focusing on eliminating the potential risk to the environment around the site and the human health from POPs after the site remediation;

Secondly, introducing that the evacuation and packaging of site contaminated soil are mainly completed within the warehouse without removing the existing building structures of Ganshui Site, making clear that the main environmental impact during the construction of Ganshui Site is the noise of transport vehicle, and proposing the mitigation measures of avoiding construction at night;

Thirdly, the Chongqing Project Office and the proprietor (Ganshui Supply and Marketing Cooperative) of Ganshui Site reach a consensus that Ganshui Supply and Marketing Cooperative will take charge of temporary relocation of residents affected by the site remediation; notify and help them to relocate, and provide temporary house (paying 4-month rent) and living allowances one month prior to the implementation of site remediation project.

Fourthly, understanding the physical condition of this household is good without serious disease caused by pesticide, and preliminarily judging the soil contamination of this site due to the storage of pesticide doesn’t have a significant impact on the physical condition of this household.

(4) Public consultation prior to environmental assessment report

Stage 1 - public consultation. Provide the potentially affected public with basic information of remediation via visits and questionnaires, and learning their knowledge of current site situation, routes of contamination and site planning before completing the final (first) draft of environment impact assessment report.

Stage 2 - face-to-face conference. Publicize the initial draft of EA report, main control and prevention measures, and organizing a conference to listen to the public opinions after completing the compilation of first draft of EA report.

On July 13, 2014, in the public consultation prior to the environmental assessment report made on site of Agricultural Material Warehouse of Ganshui, participants include: 1) 1 person from Chongqing Project Office (Lu Hailin); 2) 4 persons from compilation unit of site remediation technology plan (Zhu Xiaolong, etc. from Chongqing Solid Waste Management Service Center); 3) 1 representative of the proprietor of Ganshui Site - Ganshui Supply and Marketing Cooperative (Li Jiang) and 1 staff representative of Ganshui Supply and Marketing Cooperative (Li Xiaofang); 4) 2 consultant experts of environmental assessment and social assessment of GEF project in China (Wang Shijie and Zhong Maosheng from Beijing Municipal Research Institute of Environmental Protection); 5) 1 resident directly affected in Ganshui Site (Luo Zhaomi, female); 6) Potentially affected residents within 200 m~500 m range of remediation subproject of Ganshui Site, including 8 representatives from Tieshiya Residential Area (4 males and 5 females) and 14 representatives from residential buildings 84 and 88, Jiang Road, Ganshui Town and the winery (9 females and 5 males); 7) Staff from Ganshui police station (1 female) and power supply station (1 female) participate in the oral consultation.

Public consultation is in the form of questionnaire, as shown in Table 51 and Figure 35:

Table 51 Public Consultation Questionnaire Prior to the Disclosure of Environmental Assessment Report

I. Basic Information				
Name:	Gender:			
Age:	Occupation:			
Education:	Tel.:			
Unit or domicile:				
II. Project Profile				
In local areas (about 50m^2) of Agricultural Material Warehouse, Ganshui, Qijiang District, the soil and plastering (about 220m^3) need to be disposed due to the storage of pesticide. With the help of the Global Environment Facility (GEF), the soil and plastering within the warehouse need to be cleared, packaged and transported to the Jiangjin Lafarge Cement Plant for temporary storage. The construction time of the project is about 10 days. All constructions are conducted indoors and its main environmental impact is noise, so the construction is not allowed to be conducted at night and during lunch break in the process of project implementation. Qijiang Environmental Protection Bureau will supervise the project implementation. In case of any complaint, dial 023-12369.				
III. Investigation content				
1. Distance between living place and the target	<200m ☐	200-500m ☐		>500m ☐
2. Spread means of site contamination hazards	Air ☐	Rainwater ☐	Soil ☐	Others ☐
3. Smelt the odor of pesticide or not	Yes☐	No☐		Unclear☐
4. Hope the pollution of this site restored as soon as possible or not				
5. Biggest impact of the implementation of pollution remediation project of the site on the environment and surrounding residents	Waste gas☐	Wastewater☐ Dust☐ Transport☐		Noise☐
	Solid Waste☐	Ecology☐ Health☐ Safety☐		Others☐
6. Accept the influence produced from the project implementation or not	Acceptable☐	Doesn’t matter☐		Unacceptable☐ Reason:
7. Understand and accept the environmental protection measures adopted during the project implementation or not	Acceptable☐	Doesn’t matter☐		Unacceptable☐ Reason:
8. Agree with the implementation of this project under the premise of adopting environmental protection measures or not	Yes☐	No☐		Doesn’t matter☐
7. Overall opinions and suggestions to the implementation of this project:				

Public participation investigation table prior to environmental assessment report for Ganshui Site is as shown in Annex 17 (Third Public Questionnaires on Ganshui Site), and its result is analyzed as follows:

- The personnel participating in the public consultation can basically represent the sensitive area affected by Ganshui Site, and the distance between their living places and Ganshui Site is mostly within the range of 200-500m or < 200 m;
- There are totally 25 participants. Males account for 36%, and females account for 64%, meeting the requirements of public participation investigation; the age structure of participants is: 6 persons are ≤40 (accounting for 24% of participants) and 11 persons are ≥60 (accounting for 44% of participants); all participants are below high school in education level, most of them are farmers and individual industrialists and businessmen, and only 6 are retired workers (accounting for 24% of participants); the above circumstances meet the actual conditions that the local

young is out for work, and the rear personnel are mostly elderly, weak, women and children.

- All participants support the remediation subproject of Ganshui Site. Hope to implement as soon as possible;
- Participants are mainly concerned about problems of road traffic and noise during the site remediation. For the above influences, the formulated mitigation measures of “avoiding the construction at night and during lunch break” are universally accepted by participants.

Figure 35 On-site Public Consultation Prior to EA Report (1)(2)(3)(4) On-site discussion figure of Ganshui Site; (5) Consultation of the State Grid Corporation of China in Ganshui Town; (6)Consultation of Ganshui Police Station.

8.2.2. Project Disclosure

On July 11, 2014, Chongqing Project Office released EA report (draft, Chinese version) on the website of Appraisal Center for Environment & Engineering of Chongqing (http:http://113.204. 96.35:7890/), and advertisements was published on Chongqing Evening News, as shown in Figure 37.

不会说英语？没关系
将来吃粒药丸就能说

数字化教父尼葛洛庞帝预言：未来30年人类将“吃”进信息

中国互联网启蒙者

西南大学成教、自考
（专科、本科）招生
学历学位教育部注册国家认可

Figure 37 Screenshot of Ganshui Site’s Environmental Assessment Information Published on Chongqing Evening News

9. Summary of World Bank guidelines applied in Ganshui subproject

The relevant Bank safeguard policies are applicable to the project were precisely summarized as shown in the below Table 52, both the World Bank guidelines and national guidelines were taken into consideration for the remediation subproject of Ganshui site.

Table 52 Comparison of World Bank guidelines and measures undertaken in Ganshui EA report

World Bank Safeguard Policies and EHS Guidelines	Implementation in the EA report of Ganshui site
Environmental Screening from OP 4.01	
The Bank classifies the proposed project into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. (a) Category A: A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, 12 diverse, or unprecedented. (b) Category B: A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas--including wetlands, forests, grasslands, and other natural habitats--are less adverse than those of Category A projects. (c) Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project. (d) Category FI: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that may result in adverse environmental impacts.	Ganshui site was evaluated as Category A according to the environmental screening as shown in Annex 18 in EA report
Public Consultation from OP 4.01	
For all Category A and B projects proposed for IBRD or IDA financing, during the EA process, the borrower consults project-affected groups and local nongovernmental organizations (NGOs) about the project's environmental aspects and takes their views into account. The borrower initiates such consultations as early as possible. For Category A projects, the borrower consults these groups at least twice: (a) shortly after environmental screening and before the terms of reference for the EA are finalized; and (b) once a draft EA report is prepared. In addition, the borrower consults with such groups throughout project implementation as necessary to address EA-related issues that affect them.	Public consultation was performed as the requirements, and the result and process were recorded in section 8.2. of EA report

Disclosure from OP 4.01	
For a Category A project, the borrower provides for the initial consultation a summary of the proposed project's objectives, description, and potential impacts; for consultation after the draft EA report is prepared, the borrower provides a summary of the EA's conclusions. In addition, for a Category A project, the borrower makes the draft EA report available at a public place accessible to project-affected groups and local NGOs. For projects described in paragraph 9 above, the borrower/FI ensures that EA reports for Category A subprojects are made available in a public place accessible to affected groups and local NGOs	Public disclosure was performed as the requirements, and the result and process were recorded in section 8.2. of EA report
Environmental Health and Safety General Guidelines	
1. **The liability of contaminated land: (from section 1.8 Contaminated land of Chapter 1 Environmental in EHS general guidelines)** The liability that it may pose to the polluter/business owners (e.g., cost of remediation, damage of business reputation and/or business-community relations) or affected parties (e.g. workers at the site, nearby property owners)	The ownership was specified in section 3.4.5 of EA report
2. **Risk screening: (from section 1.8 Contaminated land of Chapter 1 Environmental in EHS general guidelines)** When the three risk factors of contaminant, receptor and exposure pathway are considered to be present (in spite of limited data) under current or foreseeable future conditions, the following steps should be followed (as described in the remaining parts of this section): ● Risk screening; ● Interim risk management; ● Detailed quantitative risk assessment; and	The environmental risk screening was conducted in Chapter 4 with the data of environmental site investigation and the result was shown in section 4.53 of EA report
3. **Monitoring** **(1) Monitoring record (from the Monitoring of section 1.6 waste management of Chapter 1 Environmental in of Chapter 1 Environmental in EHS general guidelines)** ● Name and identification number of the materials composing in the hazardous waste; ● Physical state (i.e., solid, liquid, gaseous or a combination of one, or more); ● Quantity (e.g., kilograms or liters, number of containers); ● Waste shipment tracking documentation to include, quantity and type, date dispatch, date transported and date received, record of the originator, the receiver and the transporter; ● Method and date of storing, repacking, treating, or disposing manifest document numbers applicable to the hazardous waste; ● Location of each hazardous waste within the facility, and the quantity at each location. **(2) Data quality (**from **the Monitoring of section 1.1 and 1.3 of Chapter 1 Environmental in of Chapter 1 Environmental in EHS general guidelines)** Monitoring programs should apply internationally approved methods for sample collection, preservation and analysis. Sampling should be conducted by or under the supervision of trained individuals. Analysis should be conducted by entities permitted or certified for this purpose. Sampling and analysis quality assurance/quality control (QA/QC) plans should be prepared and, implement. QA/QC documentation should be included in monitoring reports.	The sampling preparation includes preservation and transportation of soil samples, sampling method, sampling position determination, etc. in section 3.5.1.1 of EA report. The data quality of sampling and analysis was explained in section 3.5.1.2 of EA report
4. **Permanent risk reduction measure: (from section 1.8 Contaminated land of Chapter 1 Environmental in EHS general guidelines)** The underlying principle is to reduce, eliminate, or control any or all of the three risk factors. A short list of examples of risk mitigation strategies is provided below for soil, sediment, and sludge: ● In situ biological treatment (aerobic or anaerobic); ● In situ physical/chemical treatment (e.g., soil vapor extraction with off-gas treatment, chemical oxidation); ● In situ thermal treatment (e.g., steam injection, 6-phase heating); ● Ex situ biological treatment (e.g., excavation and composting); ● Ex situ physical/chemical treatment (e.g., excavation and stabilization); ● Ex situ thermal treatment (e.g., excavation and thermal desorption or incineration); ● Containment (e.g. landfill); ● Natural attenuation; Other treatment process.	For permanent risk reduction for Ganshui site, two schemes were developed with biological or thermal treatment, the remediation plan was designed in section 5.6 of EA report
5. **Planning Coordination**: cedures should be prepared for: ● Informing the public and emergency response agencies; ● Documenting first aid and emergency medical treatment;	Public disclosure was recorded in section 8.2. of EA report, and the emergency response

- Taking emergency response actions; - Reviewing and updating the emergency response plan to reflect changes, and ensuring that employees are informed of such changes.	plan was set in section 7.6 of EA report.
6. Secondary containment measures: (from section 1.5 hazardous waste management of Chapter 1 Environmental in EHS general guidelines) - Transfer of hazardous materials from vehicle tanks to storage in areas with surface sufficiently impervious to avoid loss to the environment and sloped to a collection or a containment structure not connected to municipal wastewater/stormwater collection system. - Storage of drummed hazardous material with a total volume equal or greater than l000 liters in areas with impervious surfaces that are sloped or bermed to contain a minimum of 25 percent of the total storage volume.	Secondary containment measures were evaluated and developed with mitigation actions in section 7.5 of EA report.
7. Treatment Contractor: **(from section 1.5 hazardous waste management of Chapter 1 Environmental in EHS general guidelines)** There should be a mechanism for contractor control which should include a requirement for them to develop hazard materials management procedures that meet the requirements of the hazardous materials management plan. - Ensuring that contractors handing, treating, and disposing of hazardous waste are reputable and legitimate enterprises, licensed by the relevant regulatory agencies and following good international industry practice for the waste being handled. - Provided with safety performance procedures and safety and hazard information; - Observe safety practices; - Action responsibly; - Have access to appropriate training for their employees; - Ensure that their employees know process hazards and applicable emergency actions; - Prepare and submit training records for their employees to the contracting company; - Inform their employees about the hazards presented by their work - Develop and implement procedures to manage repeated similar incidents	The requirements for site remediation contractor was set in section 7.2 of EA report.
8. **Training**: **(from section 1.5 hazardous waste management of Chapter 1 Environmental in EHS general guidelines)** Project employee should be provided training - A list of employees to be trained; - Specific training objectives; - Mechanisms to achieve the objectives (i.e., hands on workshops, videos, etc.); - The means to determine whether the training program is effective; - Training procedures for new hires and refresher courses for existing employees	The training in Ganshui site subproject was also assigned in section 7.10.3.3 of EA report
9. **Waste storag**e: **(from section 1.5 hazardous waste management of Chapter 1 Environmental in EHS general guidelines)** Hazardous waste should be stored so as to prevent or control accidental releases to air, soil, and water resources in area location where: - Waste is stored in a manner that prevents the commingling or contact between incompatible wastes, and allows for inspection between containers to monitor leaks or spill. - Store in closed containers away from direct sunlight, wind and rain; - Secondary containment systems should be constructed with materials appropriate for the wastes being contained and adequate to prevent loss to the environment - Secondary containment is included wherever liquid wastes are stored in volumes greater than 220 liters. The available volume of secondary containment should be at least 110 percent of the largest storage container, or 25 percent of the total storage capacity (whichever is greater), in that specific location; - Provide adequate ventilation where volatile wastes are stored.	The storage plan was set for the contaminated soil of Ganshui site as shown in section 5.5 of EA report.
10. Hazardous material transfer: (from section 1.5 hazardous waste management of Chapter 1 Environmental in EHS general guidelines) - Use of dedicated fittings, pipes, and hoses specific to materials in tanks (e.g., all acids use one type of connection, all caustics use another), and maintaining procedures to prevent addition of hazardous materials to incorrect tanks; - Use of transfer equipment that is compatible and suitable for the characteristics of the materials transferred and designed to ensure saft transfer; - Regular inspection, maintenance and repair of fittings pipes and hoses; - Provision of secondary containment, drip trays or other overflow and drip containment measures for hazardous materials containers at connection points	The plan for transportation of contaminated soil including route and environmental risk control, was prepared in section 5.4 of EA report.

or other possible overflow points.	
11. **Noise**: **(from 1.7 Noise of Chapter 1 Environmental in EHS general guidelines)** Noise impact should not exceed the levels, for the receptors of residential, institutional, educational use, daytime (7:00-22:00) 55 dBA, nighttime (22:00-7:00) 45 dBA	The noise was monitored during the remediation activities as shown in the table 44 of section 7.8.4 of EA report.
12. Occupational Health and Safety (from 2.0 Occupational Health and Safety in EHS general guidelines) ● Employers and supervisors are obliged to implement all reasonable precaution to protect the health and safety of workers; ● Preventive and protective measures should be included according to the following order of priority: eliminating the hazard by removing the activity from work process, controlling the hazard at its source through use of engineering controls, minimizing the hazard through design of safe work systems, providing appropriate personal protective equipment in conjunction with training, use and maintenance; ● Physical hazards include rotating and moving equipment, noise, vibration, electrical, eys hazards, welding/hot work, industrial vehicle driving and site traffic, working environment temperature, ergonomic, repetitive motion, manual handing, work at height, illumination; ● Chemical hazards include air quality, fire and explosions, corrosive, oxidizing, and reactive chemicals ● Biological hazards and radiological hazards	The risk of occupational health and safety for Ganshui site remediation was evaluated in the section 7.5 of EA report and provided mitigation actions
Involuntary Resettlement OP 4.12	
● assess the legal framework covering resettlement and the policies of the government and implementing agencies (identifying any inconsistencies between such policies and the Bank's policy); ● discuss with the agencies responsible for resettlement the policies and institutional, legal, and consultative arrangements for resettlement, including measures to address any inconsistencies between government or implementing agency policies and Bank policy; and ● In the Project Appraisal Document (PAD), the TT describes the resettlement issues, proposed resettlement instrument and measures, and the borrower's commitment to and institutional and financial capacity for implementing the resettlement instrument; ● Throughout project implementation the TL supervises the implementation of the resettlement instrument ensuring that the requisite social, financial, legal, and technical experts are included in supervision missions;	Ganshui site remediation involves only the resettlement of one household with two residents, they are not involuntary resettlement, the measures undertaken for the resettlement were shown in section 7.7 of EA report

Annexes

Annex 1	Exploration pictures of Ganshui site
Annex 2	Exploration questionnaires of Ganshui site
Annex 3	Soil sampling record of Ganshui preliminary site investigation
Annex 4	Sampling pictures of Ganshui site
Annex 5	Position measurements on Ganshui site
Annex 6	Inspection Qualification of SGS Company
Annex 7	Test report of soil samples of Ganshui preliminary site investigation
Annex 8	Sampling record of Ganshui detailed site investigation
Annex 9	Test report of Ganshui detailed site investigation
Annex 10	Geological bore record of Ganshui site
Annex 11	Test report of Ganshui supplementary site investigation
Annex 12	Scaffold construction design plan
Annex 13	Relevant documents of Lafarge Cement Plant
Annex 14	Ownership complement of house provided by Ganshui Supply and Marketing Cooperative
Annex 15	First public questionnaires on Ganshui site
Annex 16	Second public questionnaires on Ganshui site
Annex 17	Third public questionnaires on Ganshui site
Annex 18	Environmental screening for Ganshui site

Annex 1 Exploration pictures of the Ganshui site

Overall condition

Right side of the warehous

Back side of the warehouse

Inside of the warehouse

Inside of keeping room

Inside of the pesticide storage room

Annex 1 Exploration pictures of the Ganshui site

Overall condition

Right side of the warehous

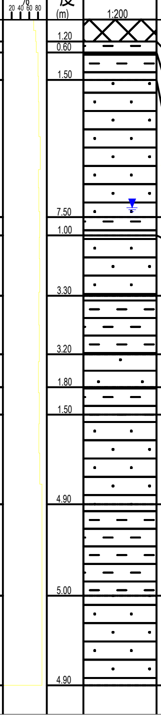
Back side of the warehouse

Inside of the warehouse

Inside of keeping room

Inside of the pesticide storage room

孔口高程	152.89m	坐标	x = 3181609.20m	开工日期	2014.03.12	稳定水位深度	10.50m
孔口直径	110.00mm		y = 500298.93m	竣工日期	2014.03.17	测量水位日期	2014.03.17



地层编号	时代成因	层底高程 (m)	层底深度 (m)	岩芯采取率 %	分层厚度 (m)	柱状图	岩土名称及其特征	取样	稳定水位 (m) 和水位日期
①	Q_4^{ml}	151.69	1.20		1.20		素填土：紫红色，主要由粉质粘土夹砂，泥岩碎块石组成。粉质粘土呈可松散状，碎块石含量 40%，堆土方式随意，排列杂乱，堆填时间约为3～2年。呈松散状。		
②$_1$		151.09	1.80		0.60		强风化泥岩：紫红色、暗紫色，粘土矿物成分，泥质结构，中厚层状构造，局部夹砂质条带，岩芯呈碎块及散粒状，岩块手捏碎，风化裂隙发育，为强风化层。		
②$_2$		149.59	3.30		1.50		中风化泥岩：紫红色、暗紫色，粘土矿物成分，泥质结构，中厚层状构造，局部夹砂质条带。岩芯呈柱状，节长8~20cm，岩石强度较高，		
③$_2$		142.09	10.80		7.50		中等风化砂岩:灰白色、白色。矿物成分主要为石英、长石及云母、暗色矿物等，细～中粒结构，钙质胶结，厚层状构造,岩芯呈柱状，节长13～23m，层理清晰，岩石强度较高，岩芯较完整锤击声脆，为中等风化层,距离孔口位置6.1～6.4m位置有裂隙此裂隙没见地下水。		142.39 2014
②$_2$		141.09	11.80		1.00		中风化泥岩：紫红色、暗紫色，粘土矿物成分，泥质结构，中厚层状构造，局部夹砂质条带。岩芯呈柱状，节长6~22cm，岩石强度较高，		
③$_2$		137.79	15.10		3.30		中等风化砂岩:灰白色、白色。矿物成分主要为石英、长石及云母、暗色矿物等，细～中粒结构，钙质胶结，厚层状构造,岩芯呈柱状，节长8～20m，层理清晰，岩石强度较高，岩芯较完整锤击声脆，为中等风化层,距离孔口位置12.0～12.3m位置有裂隙此裂隙有少量地下水。		
②$_2$		134.59	18.30		3.20		中风化泥岩：紫红色、暗紫色，粘土矿物成分，泥质结构，中厚层状构造，局部夹砂质条带。岩芯呈柱状，节长10~30cm，岩石强度较高，		
③$_2$	J_2s	132.79	20.10		1.80		中等风化砂岩:灰白色、白色。矿物成分主要为石英、长石及云母、暗色矿物等，细～中粒结构，钙质胶结，厚层状构造,岩芯呈柱状，节长10～23m，层理清晰，岩石强度较高，岩芯较完整锤击声脆，为中等风化层		
②$_2$		131.29	21.60		1.50		中风化泥岩：紫红色、暗紫色，粘土矿物成分，泥质结构，中厚层状构造，局部夹砂质条带。岩芯呈柱状，节长8~19cm，岩石强度较高，		
③$_2$		126.39	26.50		4.90		中等风化砂岩:灰白色、白色。矿物成分主要为石英、长石及云母、暗色矿物等，细～中粒结构，钙质胶结，厚层状构造,岩芯呈柱状，节长11～20m，层理清晰，岩石强度较高，岩芯较完整锤击声脆，为中等风化层,距离孔口位置23.2～23.5m位置有裂隙,裂隙面有结晶体，次裂隙地下水丰富。		
②$_2$		121.39	31.50		5.00		中风化泥岩：紫红色、暗紫色，粘土矿物成分，泥质结构，中厚层状构造，泥岩砂质含量较高。岩芯呈柱状，节长8~25cm，岩石强度较高，		
③$_2$		116.49	36.40		4.90		中等风化砂岩:灰白色、白色。矿物成分主要为石英、长石及云母、暗色矿物等，细～中粒结构，钙质胶结，厚层状构造,岩芯呈柱状，节长10～25m，层理清晰，岩石强度较高，岩芯较完整锤击声脆，为中等风化层		

孔口高程	152.89m	坐	x = 3181609.20m	开工日期	2014.03.12	稳定水位深度	10.50m
孔口直径	110.00mm	标	y = 500298.93m	竣工日期	2014.03.17	测量水位日期	2014.03.17

地层编号	时代成因	层底高程 (m)	层底深度 (m)	岩芯采取率 % 20 40 60 80	分层厚度 (m)	柱状图 1:200	岩土名称及其特征	取样	稳定水位 (m) 和 水位日期
①	Q_4^{ml}	151.69	1.20		1.20		素填土：紫红色，主要由粉质粘土夹砂，泥岩碎块石组成。粉质粘土呈可松散状，碎块石含量40%，堆土方式随意，排列杂乱，堆填时间约为3～2年。呈松散状。		
②$_1$	J_2s	151.09	1.80		0.60		强风化泥岩：紫红色、暗紫色，粘土矿物成分，泥质结构，中厚层状构造，局部夹砂质条带，岩芯呈碎块及散粒状，岩块手捏碎，风化裂隙发育，为强风化层。		
②$_2$		149.59	3.30		1.50		中风化泥岩：紫红色、暗紫色，粘土矿物成分，泥质结构，中厚层状构造，局部夹砂质条带。岩芯呈柱状，节长8~20cm，岩石强度较高，		
③$_2$		142.09	10.80		7.50		中等风化砂岩:灰白色、白色。矿物成分主要为石英、长石及云母、暗色矿物等，细~中粒结构，钙质胶结，厚层状构造,岩芯呈柱状，节长13~23m，层理清晰，岩石强度较高，岩芯较完整锤击声脆，为中等风化层,距离孔口位置6.1~6.4m位置有裂隙此裂隙没见地下水。		142.39 2014
②$_2$		141.09	11.80		1.00		中风化泥岩：紫红色、暗紫色，粘土矿物成分，泥质结构，中厚层状构造，局部夹砂质条带。岩芯呈柱状，节长6~22cm，岩石强度较高，		
③$_2$		137.79	15.10		3.30		中等风化砂岩:灰白色、白色。矿物成分主要为石英、长石及云母、暗色矿物等，细~中粒结构，钙质胶结，厚层状构造,岩芯呈柱状，节长8~20m，层理清晰，岩石强度较高，岩芯较完整锤击声脆，为中等风化层,距离孔口位置12.0~12.3m位置有裂隙此裂隙有少量地下水。		
②$_2$		134.59	18.30		3.20		中风化泥岩：紫红色、暗紫色，粘土矿物成分，泥质结构，中厚层状构造，局部夹砂质条带。岩芯呈柱状，节长10~30cm，岩石强度较高，		
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②$_2$		131.29	21.60		1.50		中风化泥岩：紫红色、暗紫色，粘土矿物成分，泥质结构，中厚层状构造，局部夹砂质条带。岩芯呈柱状，节长8~19cm，岩石强度较高，		
③$_2$		126.39	26.50		4.90		中等风化砂岩:灰白色、白色。矿物成分主要为石英、长石及云母、暗色矿物等，细~中粒结构，钙质胶结，厚层状构造,岩芯呈柱状，节长11~20m，层理清晰，岩石强度较高，岩芯较完整锤击声脆，为中等风化层,距离孔口位置23.2~23.5m位置有裂隙,裂隙面有结晶体，次裂隙地下水丰富。		
②$_2$		121.39	31.50		5.00		中风化泥岩：紫红色、暗紫色，粘土矿物成分，泥质结构，中厚层状构造，泥岩砂质含量较高。岩芯呈柱状，节长8~25cm，岩石强度较高，		
③$_2$		116.49	36.40		4.90		中等风化砂岩:灰白色、白色。矿物成分主要为石英、长石及云母、暗色矿物等，细~中粒结构，钙质胶结，厚层状构造,岩芯呈柱状，节长10~25m，层理清晰，岩石强度较高，岩芯较完整锤击声脆，为中等风化层		

TEST REPORT

CLIENT DETAILS		LABORATORY DETAILS	
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Client	MANAGEMENT AND SERVICE CENTER FOR SOLID WASTES OF CHONGQING	Laboratory	Shanghai Enviromental Services
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Email	-	Email	REPORT.ENV @SGS.COM
Order Number	**-**	Report Number	SHE14-00690 R0
Samples	Soil(29) Solid(11) Water(2)	SGS Reference	0000015441
Project	**Gan Shui Site**	Date Reported	2014/04/08

COMMENTS

1.This test document cannot be reproduced in any way, except in full content, without prior approval in writing by the laboratory.
2.The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

SIGNATORIES

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Authorized Signatory

		Sample Number	14-00690.001	14-00690.038
		Sample Name	地下水1#	地下水2#
		Sample Matrix	Water	Water
		Sample Description	-	-
		Receive Date	2014/03/18	2014/03/18
Parameter	Units	LOR		
pH VALUE, Glass electrode method Method: APHA 4500H^+-2012				
pH	-	-	7.6	6.8

		Sample Number	14-00690.001	14-00690.038
		Sample Name	地下水1#	地下水2#
		Sample Matrix	Water	Water
		Sample Description	-	-
		Receive Date	2014/03/18	2014/03/18
Parameter	Units	LOR		

Metals ICP-MS Method: USEPA 200.8-1994

Arsenic (As)	μg/L	5	<5	<5
Lead (Pb)	μg/L	1	<1	<1

		Sample Number	14-00690.001	14-00690.038
		Sample Name	地下水1#	地下水2#
		Sample Matrix	Water	Water
		Sample Description	-	-
		Receive Date	2014/03/18	2014/03/18
Parameter	Units	LOR		

Metals-Hg Method: USEPA 7473-1998

Mercury (Hg)	μg/L	0.1	<0.1	<0.1

		Sample Number	14-00690.001	14-00690.038
		Sample Name	地下水1#	地下水2#
		Sample Matrix	Water	Water
		Sample Description	-	-
		Receive Date	2014/03/18	2014/03/18
Parameter	**Units**	**LOR**		

SVOCs   Method: USEPA 8270D-2007

SURROGATES				
2-Fluorophenol	%	-	76	44
Phenol-d6	%	-	44	45
Nitrobenzene-d5	%	-	108	82
2-Fluorobiphenyl	%	-	111	70
2,4,6-Tribromophenol	%	-	96	80
p-Terphenyl-d14	%	-	120	114
PHENOLS				
Phenol	µg/L	0.5	<0.5	<0.5
2-Chlorophenol	µg/L	0.5	<0.5	<0.5
2-Methylphenol	µg/L	0.5	<0.5	<0.5
3&4-Methylphenol	µg/L	0.5	<0.5	<0.5
2-Nitrophenol	µg/L	0.5	<0.5	<0.5
2,4-Dimethylphenol	µg/L	0.5	<0.5	<0.5
2,4-Dichlorophenol	µg/L	0.5	<0.5	<0.5
4-Chloro-3-methylphenol	µg/L	2.5	<2.5	<2.5
2,6-Dichlorophenol	µg/L	0.5	<0.5	<0.5
2,3,4,6-Tetrachlorophenol	µg/L	2.5	<2.5	<2.5
2,4,6-Trichlorophenol	µg/L	0.5	<0.5	<0.5
2,4,5-Trichlorophenol	µg/L	0.5	<0.5	<0.5
2,4-Dinitrophenol	µg/L	2.5	<2.5	<2.5
4-Nitrophenol	µg/L	2.5	<2.5	<2.5
4,6-Dinitro-2-methylphenol	µg/L	2.5	<2.5	<2.5
Pentachlorophenol	µg/L	2.5	<2.5	<2.5
POLYNUCLEAR AROMATIC HYDROCARBONS				
Naphthalene	µg/L	0.2	<0.2	<0.2
2-Methylnaphthalene	µg/L	0.5	<0.5	<0.5
2-Chloronaphthalene	µg/L	0.5	<0.5	<0.5
Acenaphthylene	µg/L	0.2	<0.2	<0.2
Acenaphthene	µg/L	0.2	<0.2	<0.2
Fluorene	µg/L	0.2	<0.2	<0.2
Phenanthrene	µg/L	0.2	<0.2	<0.2
Anthracene	µg/L	0.2	<0.2	<0.2
Fluoranthene	µg/L	0.2	<0.2	<0.2
Pyrene	µg/L	0.2	<0.2	<0.2
Benzo(a)anthracene	µg/L	0.2	<0.2	<0.2
Chrysene	µg/L	0.2	<0.2	<0.2

		Sample Number	14-00690.001	14-00690.038
		Sample Name	地下水1#	地下水2#
		Sample Matrix	Water	Water
		Sample Description	-	-
		Receive Date	2014/03/18	2014/03/18
Parameter	Units	LOR		
SVOCs Method: USEPA 8270D-2007 (continued)				
7,12-Dimethylbenz(a)anthracene	μg/L	0.5	<0.5	<0.5
Benzo(b)fluoranthene	μg/L	0.05	<0.05	<0.05
Benzo(k)fluoranthene	μg/L	0.05	<0.05	<0.05
Benzo(a)pyrene	μg/L	0.05	<0.05	<0.05
Indeno(1,2,3-cd)pyrene	μg/L	0.05	<0.05	<0.05
Dibenzo(a,h)anthracene	μg/L	0.2	<0.2	<0.2
Benzo(g,h,i)perylene	μg/L	0.05	<0.05	<0.05
PHTHALATE ESTERS				
Dimethylphthalate	μg/L	0.5	<0.5	<0.5
Diethylphthalate	μg/L	0.5	<0.5	<0.5
Di-n-butylphthalate	μg/L	0.5	<0.5	<0.5
Butyl benzyl phthalate	μg/L	0.5	<0.5	<0.5
Bis(2-ethylhexyl)phthalate	μg/L	2.5	<2.5	<2.5
Di-n-octylphthalate	μg/L	0.5	<0.5	<0.5
NITROSAMINES				
N-Nitrosodimethylamine	μg/L	0.5	<0.5	<0.5
N-Nitrosodi-n-propylamine	μg/L	0.5	<0.5	<0.5
N-Nitrosomethylethylamine	μg/L	2.5	<2.5	<2.5
N-Nitrosodiethylamine	μg/L	0.5	<0.5	<0.5
N-Nitrosopiperidine	μg/L	0.5	<0.5	<0.5
N-Nitrosomorpholine	μg/L	0.5	<0.5	<0.5
N-Nitrosodi-n-butylamine	μg/L	0.5	<0.5	<0.5
Diphenylamine&N-Nitrosodiphenylamine	μg/L	0.5	<0.5	<0.5
Methapyrilene	μg/L	2.5	<2.5	<2.5
NITROAROMATICS AND CYCLIC KETONES				
Acetophenone	μg/L	0.5	<0.5	<0.5
Nitrobenzene	μg/L	0.5	<0.5	<0.5
Isophorone	μg/L	0.5	<0.5	<0.5
1,3-Dinitrobenzene	μg/L	2.5	<2.5	<2.5
1-Naphthylamine	μg/L	0.5	<0.5	<0.5
2-Naphthylamine	μg/L	0.5	<0.5	<0.5
2,6-Dinitrotoluene	μg/L	0.5	<0.5	<0.5
2,4-Dinitrotoluene	μg/L	0.5	<0.5	<0.5
1,3,5-Trinitrobenzene	μg/L	0.5	<0.5	<0.5
Pentachloronitrobenzene	μg/L	0.5	<0.5	<0.5
5-Nitro-o-toluidine	μg/L	0.5	<0.5	<0.5
Phenacetin	μg/L	0.5	<0.5	<0.5

		Sample Number Sample Name Sample Matrix Sample Description Receive Date	14-00690.001 地下水1# Water - 2014/03/18	14-00690.038 地下水2# Water - 2014/03/18
Parameter	Units	LOR		

SVOCs Method: USEPA 8270D-2007 (continued)

4-Aminobiphenyl	μg/L	0.5	<0.5	<0.5
Azobenzene	μg/L	0.5	<0.5	<0.5
Propyzamide	μg/L	0.5	<0.5	<0.5
P-Dimethylaminoazobenzene	μg/L	0.5	<0.5	<0.5
HALOETHERS				
Bis(2-chloroethyl) ether	μg/L	2.5	<2.5	<2.5
Bis(2-chloroisopropyl)ether	μg/L	2.5	<2.5	<2.5
Bis(2-chloroethoxy) methane	μg/L	2.5	<2.5	<2.5
4-Chlorophenyl phenyl ether	μg/L	2.5	<2.5	<2.5
4-Bromophenyl phenyl ether	μg/L	2.5	<2.5	<2.5
CHLORINATED HYDROCARBONS				
1,3-Dichlorobenzene	μg/L	0.5	<0.5	<0.5
1,4-Dichlorobenzene	μg/L	0.5	<0.5	<0.5
1,2-Dichlorobenzene	μg/L	0.5	<0.5	<0.5
Hexachloroethane	μg/L	0.5	<0.5	<0.5
Pentachloroethane	μg/L	0.5	<0.5	<0.5
1,3,5-Trichlorobenzene	μg/L	0.5	<0.5	<0.5
1,2,4-Trichlorobenzene	μg/L	0.5	<0.5	<0.5
Hexachlorobutadiene	μg/L	0.5	<0.5	<0.5
Hexachloropropene	μg/L	0.5	<0.5	<0.5
Hexachlorocyclopentadiene	μg/L	2.5	<2.5	<2.5
Pentachlorobenzene	μg/L	0.5	<0.5	<0.5
1,2,4,5-Tetrachlorobenzene	μg/L	0.5	<0.5	<0.5
Hexachlorobenzene	μg/L	0.5	<0.5	<0.5
ANILINES AND BENZIDINES				
Aniline	μg/L	2.5	<2.5	<2.5
o-Toluidine	μg/L	0.5	<0.5	<0.5
4-Chloroaniline	μg/L	0.5	<0.5	<0.5
2-Nitroaniline	μg/L	0.5	<0.5	<0.5
3-Nitroaniline	μg/L	0.5	<0.5	<0.5
Dibenzofuran	μg/L	0.5	<0.5	<0.5
4-Nitroaniline	μg/L	0.5	<0.5	<0.5
Carbazole	μg/L	0.5	<0.5	<0.5

Parameter	Units	LOR	14-00690.001	14-00690.038
Sample Number			14-00690.001	14-00690.038
Sample Name			地下水1#	地下水2#
Sample Matrix			Water	Water
Sample Description			-	-
Receive Date			2014/03/18	2014/03/18

OCP Method: USEPA 8081B-2007

Parameter	Units	LOR	14-00690.001	14-00690.038
SURROGATES				
Tetrachloro-m-xylene	%	-	107	75
Decachlorobiphenyl	%	-	106	96
ORGANOCHLORINE PESTICIDES				
α-BHC	μg/L	0.1	<0.1	<0.1
γ-BHC	μg/L	0.1	<0.1	<0.1
β-BHC	μg/L	0.1	<0.1	<0.1
Heptachlor	μg/L	0.1	<0.1	<0.1
δ-BHC	μg/L	0.1	<0.1	<0.1
Aldrin	μg/L	0.1	<0.1	<0.1
Heptachlor epoxide	μg/L	0.1	<0.1	<0.1
γ-Chlordane	μg/L	0.1	<0.1	<0.1
Trans-nonachlor	μg/L	0.1	<0.1	<0.1
Endosulfan I	μg/L	0.1	<0.1	<0.1
α-Chlordane	μg/L	0.1	<0.1	<0.1
o,p'-DDE	μg/L	0.1	<0.1	<0.1
p,p'-DDE	μg/L	0.1	<0.1	<0.1
Dieldrin	μg/L	0.1	<0.1	<0.1
o,p'-DDD	μg/L	0.1	<0.1	<0.1
Endrin	μg/L	0.1	<0.1	<0.1
Cis-Nonachlor	μg/L	0.1	<0.1	<0.1
p,p'-DDD	μg/L	0.1	<0.1	<0.1
o,p'-DDT	μg/L	0.1	<0.1	<0.1
Endosulfan II	μg/L	0.1	<0.1	<0.1
p,p'-DDT	μg/L	0.1	<0.1	<0.1
Endrin aldehyde	μg/L	0.1	<0.1	<0.1
Endosulfan sulfate	μg/L	0.1	<0.1	<0.1
Methoxychlor	μg/L	0.1	<0.1	<0.1
Endrin ketone	μg/L	0.1	<0.1	<0.1

		Sample Number	14-00690.001	14-00690.038
		Sample Name	地下水1#	地下水2#
		Sample Matrix	Water	Water
		Sample Description	-	-
		Receive Date	2014/03/18	2014/03/18
Parameter	Units	LOR		

VOCs Method: USEPA 8260C-2006

SURROGATES				
Toluene-d8	%	-	100	94
4-Bromofluorobenzene	%	-	96	98
Dibromofluoromethane	%	-	105	113
MONOCYCLIC AROMATIC HYDROCARBONS				
Benzene	µg/L	0.5	<0.5	<0.5
Toluene	µg/L	0.5	<0.5	<0.5
Ethylbenzene	µg/L	0.5	<0.5	<0.5
meta&para-Xylene	µg/L	0.5	<0.5	<0.5
Styrene	µg/L	0.5	<0.5	<0.5
ortho-Xylene	µg/L	0.5	<0.5	<0.5
Isopropylbenzene	µg/L	0.5	<0.5	<0.5
n-Propylbenzene	µg/L	0.5	<0.5	<0.5
1,3,5-Trimethylbenzene	µg/L	0.5	<0.5	<0.5
tert-butylbenzene	µg/L	0.5	<0.5	<0.5
1,2,4-Trimethylbenzene	µg/L	0.5	<0.5	<0.5
sec-Butylbenzene	µg/L	0.5	<0.5	<0.5
p-Isopropyltoluene	µg/L	0.5	<0.5	<0.5
n-Butylbenzene	µg/L	0.5	<0.5	<0.5
FUMIGANTS				
2,2-Dichloropropane	µg/L	0.5	<0.5	<0.5
1,2-Dichloropropane	µg/L	0.5	<0.5	<0.5
cis-1,3-Dichloropropene	µg/L	0.5	<0.5	<0.5
trans-1,3-Dichloropropene	µg/L	0.5	<0.5	<0.5
1,2-Dibromoethane	µg/L	0.5	<0.5	<0.5
HALOGENATED ALIPHATIC HYDROCARBONS				
Dichlorodifluoromethane	µg/L	0.5	<0.5	<0.5
Chloromethane	µg/L	0.5	**2.7**	<0.5
Vinyl chloride	µg/L	0.5	<0.5	<0.5
Bromomethane	µg/L	0.5	<0.5	<0.5
Chloroethane	µg/L	0.5	<0.5	<0.5
Trichlorofluoromethane	µg/L	0.5	<0.5	<0.5
1,1-Dichloroethene	µg/L	0.5	<0.5	<0.5
Methylene chloride	µg/L	5	<5	<5
trans-1,2-Dichloroethene	µg/L	0.5	<0.5	<0.5
1,1-Dichloroethane	µg/L	0.5	<0.5	<0.5
cis-1,2-Dichloroethene	µg/L	0.5	<0.5	<0.5

		Sample Number	14-00690.001	14-00690.038
		Sample Name	地下水1#	地下水2#
		Sample Matrix	Water	Water
		Sample Description	-	-
		Receive Date	2014/03/18	2014/03/18
Parameter	Units	LOR		

VOCs Method: USEPA 8260C-2006 (continued)

Parameter	Units	LOR	14-00690.001	14-00690.038
Bromochloromethane	μg/L	0.5	<0.5	<0.5
1,1,1-trichloroethane	μg/L	0.5	<0.5	<0.5
1,1-Dichloropropene	μg/L	0.5	<0.5	<0.5
Carbon tetrachloride	μg/L	0.5	<0.5	<0.5
1,2-Dichloroethane	μg/L	0.5	**0.9**	<0.5
Trichloroethene	μg/L	0.5	<0.5	<0.5
Dibromomethane	μg/L	0.5	<0.5	<0.5
1,1,2-Trichloroethane	μg/L	0.5	<0.5	<0.5
1,3-Dichloropropane	μg/L	0.5	<0.5	<0.5
Tetrachloroethene	μg/L	0.5	<0.5	<0.5
1,1,1,2-Tetrachloroethane	μg/L	0.5	<0.5	<0.5
1,1,2,2-Tetrachloroethane	μg/L	0.5	<0.5	<0.5
1,2,3-Trichloropropane	μg/L	0.5	<0.5	<0.5
1,2-Dibromo-3-chloropropane	μg/L	0.5	<0.5	<0.5
Hexachlorobutadiene	μg/L	0.5	<0.5	<0.5
HALOGENATED AROMATIC HYDROCARBONS				
Chlorobenzene	μg/L	0.5	<0.5	<0.5
Bromobenzene	μg/L	0.5	<0.5	<0.5
2-Chlorotoluene	μg/L	0.5	<0.5	<0.5
4-Chlorotoluene	μg/L	0.5	<0.5	<0.5
1,3-Dichlorobenzene	μg/L	0.5	<0.5	<0.5
1,4-Dichlorobenzene	μg/L	0.5	<0.5	<0.5
1,2-Dichlorobenzene	μg/L	0.5	<0.5	<0.5
1,2,4-Trichlorobenzene	μg/L	0.5	<0.5	<0.5
1,2,3-Trichlorobenzene	μg/L	0.5	<0.5	<0.5
THMS				
Chloroform	μg/L	0.5	**3.4**	<0.5
Bromodichloromethane	μg/L	0.5	**1.5**	<0.5
Dibromochloromethane	μg/L	0.5	**1.2**	<0.5
Bromoform	μg/L	0.5	<0.5	<0.5
NAPHTHALENE				
Naphthalene	μg/L	0.5	<0.5	<0.5

		Sample Number	14-00690.011	14-00690.012	14-00690.013
		Sample Name	9#-2	9#-3	9#-4
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	82.5	83.2	85.6

		Sample Number	14-00690.011	14-00690.012	14-00690.013
		Sample Name	9#-2	9#-3	9#-4
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	5.8	4.3	6.2

		Sample Number	14-00690.014	14-00690.016	14-00690.017
		Sample Name	9#-5	10#-2	10#-3
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	83.5	83.4	84.3

		Sample Number	14-00690.014	14-00690.016	14-00690.017
		Sample Name	9#-5	10#-2	10#-3
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	4.0	7.4	7.4

		Sample Number	14-00690.018	14-00690.019	14-00690.021
		Sample Name	10#-4	10#-5	11#-2
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	82.6	80.4	83.8

		Sample Number	14-00690.018	14-00690.019	14-00690.021
		Sample Name	10#-4	10#-5	11#-2
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	7.5	7.2	5.6

		Sample Number	14-00690.022	14-00690.023	14-00690.024
		Sample Name	11#-3	11#-4	11#-5
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	82.4	82.9	84.5

		Sample Number	14-00690.022	14-00690.023	14-00690.024
		Sample Name	11#-3	11#-4	11#-5
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	7.4	7.4	7.7

		Sample Number	14-00690.025	14-00690.026	14-00690.027
		Sample Name	12#-1	12#-2	12#-3
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Soil. Determination of dry matter and water content. Gravimetric method   Method: HJ 613-2011

Dry weight	%	-	80.6	83.8	83.2

		Sample Number	14-00690.025	14-00690.026	14-00690.027
		Sample Name	12#-1	12#-2	12#-3
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Examination of pH in Soil and castoff   Method: USEPA 9045D-2004

pH	-	-	5.8	4.1	5.1

		Sample Number	14-00690.028	14-00690.029	14-00690.030
		Sample Name	13#-1	13#-2	13#-3
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Soil. Determination of dry matter and water content. Gravimetric method   Method: HJ 613-2011

Dry weight	%	-	83.5	82.0	88.3

		Sample Number	14-00690.028	14-00690.029	14-00690.030
		Sample Name	13#-1	13#-2	13#-3
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Examination of pH in Soil and castoff   Method: USEPA 9045D-2004

pH	-	-	4.7	4.8	4.8

		Sample Number	14-00690.031	14-00690.032	14-00690.033
		Sample Name	14#-1	14#-2	14#-3
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	84.7	83.6	84.3

		Sample Number	14-00690.031	14-00690.032	14-00690.033
		Sample Name	14#-1	14#-2	14#-3
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	4.7	4.0	3.9

		Sample Number	14-00690.034	14-00690.035	14-00690.036
		Sample Name	15#-2	17#	9#
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	82.9	78.6	81.8

		Sample Number	14-00690.034	14-00690.035	14-00690.036
		Sample Name	15#-2	17#	9#
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	6.1	7.2	5.8

		Sample Number	14-00690.037	14-00690.039	14-00690.040
		Sample Name	10#	15#-1	16#-1
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	83.2	85.9	88.6

		Sample Number	14-00690.037	14-00690.039	14-00690.040
		Sample Name	10#	15#-1	16#-1
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	7.4	7.8	7.6

		Sample Number	14-00690.041	14-00690.042
		Sample Name	16#-2	对照样品
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/03/18	2014/03/18
Parameter	Units	LOR		

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	84.0	83.2

		Sample Number	14-00690.041	14-00690.042
		Sample Name	16#-2	对照样品
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/03/18	2014/03/18
Parameter	Units	LOR		

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	7.5	6.9

		Sample Number	14-00690.011	14-00690.012	14-00690.013
		Sample Name	9#-2	9#-3	9#-4
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			
Appendix A Inductively coupled plasma-atomic emission spectrometry			**Method: HJ 350-2007 Appendix A**		
Arsenic (As)	mg/Kg	0.5	**2.5**	**1.2**	**1.2**
Lead (Pb)	mg/Kg	0.1	**18.8**	**16.6**	**16.0**

		Sample Number	14-00690.011	14-00690.012	14-00690.013
		Sample Name	9#-2	9#-3	9#-4
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			
Mercury in solids and solutions by atomoc absorption spectrophotometry			**Method: USEPA 7473-1998**		
Mercury (Hg)	mg/Kg	0.01	**0.11**	**0.10**	**0.29**

		Sample Number	14-00690.014	14-00690.016	14-00690.017
		Sample Name	9#-5	10#-2	10#-3
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			
Appendix A Inductively coupled plasma-atomic emission spectrometry			**Method: HJ 350-2007 Appendix A**		
Arsenic (As)	mg/Kg	0.5	**0.8**	**3.5**	**2.7**
Lead (Pb)	mg/Kg	0.1	**17.0**	**19.3**	**17.2**

		Sample Number	14-00690.014	14-00690.016	14-00690.017
		Sample Name	9#-5	10#-2	10#-3
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			
Mercury in solids and solutions by atomoc absorption spectrophotometry			**Method: USEPA 7473-1998**		
Mercury (Hg)	mg/Kg	0.01	**0.16**	**0.16**	**0.14**

		Sample Number	14-00690.018	14-00690.019	14-00690.021
		Sample Name	10#-4	10#-5	11#-2
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**4.9**	**9.7**	**2.8**
Lead (Pb)	mg/Kg	0.1	**19.3**	**24.1**	**21.2**

		Sample Number	14-00690.018	14-00690.019	14-00690.021
		Sample Name	10#-4	10#-5	11#-2
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-1998

Mercury (Hg)	mg/Kg	0.01	**0.11**	**0.10**	**0.16**

		Sample Number	14-00690.022	14-00690.023	14-00690.024
		Sample Name	11#-3	11#-4	11#-5
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**3.0**	**2.1**	**2.7**
Lead (Pb)	mg/Kg	0.1	**18.0**	**20.9**	**19.2**

		Sample Number	14-00690.022	14-00690.023	14-00690.024
		Sample Name	11#-3	11#-4	11#-5
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-1998

Mercury (Hg)	mg/Kg	0.01	**0.22**	**0.12**	**0.10**

Sample Number			14-00690.025	14-00690.026	14-00690.027
Sample Name			12#-1	12#-2	12#-3
Sample Matrix			Soil	Soil	Soil
Sample Description			-	-	-
Receive Date			2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**2.8**	**1.4**	**0.7**
Lead (Pb)	mg/Kg	0.1	**59.4**	**13.7**	**12.9**

Sample Number			14-00690.025	14-00690.026	14-00690.027
Sample Name			12#-1	12#-2	12#-3
Sample Matrix			Soil	Soil	Soil
Sample Description			-	-	-
Receive Date			2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-1998

Mercury (Hg)	mg/Kg	0.01	**0.14**	**0.05**	**0.06**

Sample Number			14-00690.028	14-00690.029	14-00690.030
Sample Name			13#-1	13#-2	13#-3
Sample Matrix			Soil	Soil	Soil
Sample Description			-	-	-
Receive Date			2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**1.7**	**1.5**	**1.9**
Lead (Pb)	mg/Kg	0.1	**14.4**	**18.7**	**17.6**

Sample Number			14-00690.028	14-00690.029	14-00690.030
Sample Name			13#-1	13#-2	13#-3
Sample Matrix			Soil	Soil	Soil
Sample Description			-	-	-
Receive Date			2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-1998

Mercury (Hg)	mg/Kg	0.01	**0.10**	**0.12**	**0.03**

		Sample Number	14-00690.031	14-00690.032	14-00690.033
		Sample Name	14#-1	14#-2	14#-3
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**2.6**	**1.2**	**2.4**
Lead (Pb)	mg/Kg	0.1	**22.0**	**15.2**	**22.9**

		Sample Number	14-00690.031	14-00690.032	14-00690.033
		Sample Name	14#-1	14#-2	14#-3
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-1998

Mercury (Hg)	mg/Kg	0.01	**0.19**	**0.13**	**0.14**

		Sample Number	14-00690.034	14-00690.035	14-00690.039
		Sample Name	15#-2	17#	15#-1
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**4.5**	**46.0**	**5.9**
Lead (Pb)	mg/Kg	0.1	**20.7**	**19.4**	**20.5**

		Sample Number	14-00690.034	14-00690.035	14-00690.039
		Sample Name	15#-2	17#	15#-1
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-1998

Mercury (Hg)	mg/Kg	0.01	**0.14**	**0.98**	**0.21**

		Sample Number	14-00690.040	14-00690.041	14-00690.042
		Sample Name	16#-1	16#-2	对照样品
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			
Appendix A Inductively coupled plasma-atomic emission spectrometry		**Method: HJ 350-2007 Appendix A**			
Arsenic (As)	mg/Kg	0.5	**34.1**	**81.4**	**2.0**
Lead (Pb)	mg/Kg	0.1	**20.0**	**18.9**	**19.8**

		Sample Number	14-00690.040	14-00690.041	14-00690.042
		Sample Name	16#-1	16#-2	对照样品
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			
Mercury in solids and solutions by atomoc absorption spectrophotometry		**Method: USEPA 7473-1998**			
Mercury (Hg)	mg/Kg	0.01	**0.20**	**0.21**	**0.07**

Parameter	Units	LOR	14-00690.036	14-00690.037
Sample Number			14-00690.036	14-00690.037
Sample Name			9#	10#
Sample Matrix			Soil	Soil
Sample Description			-	-
Receive Date			2014/03/18	2014/03/18

Appendix D SVOCs Method: HJ 350-2007 Appendix D

Parameter	Units	LOR	14-00690.036	14-00690.037
SURROGATES				
2-Fluorophenol	%	-	98	81
Phenol-d6	%	-	104	80
Nitrobenzene-d5	%	-	101	80
2-Fluorobiphenyl	%	-	103	78
2,4,6-Tribromophenol	%	-	92	101
p-Terphenyl-d14	%	-	93	93
SVOCs				
2-Chlorophenol	mg/Kg	0.1	<0.1	<0.1
2-Methylphenol	mg/Kg	0.1	<0.1	<0.1
2-Nitrophenol	mg/Kg	0.1	<0.1	<0.1
2,4-Dimethylphenol	mg/Kg	0.1	<0.1	<0.1
2,4-Dichlorophenol	mg/Kg	0.1	<0.1	<0.1
2,4,6-Trichlorophenol	mg/Kg	0.1	<0.1	<0.1
2,4,5-Trichlorophenol	mg/Kg	0.1	<0.1	<0.1
2,4-Dinitrophenol	mg/Kg	0.5	<0.5	<0.5
4,6-Dinitro-2-methylphenol	mg/Kg	0.5	<0.5	<0.5
Naphthalene	mg/Kg	0.1	<0.1	<0.1
2-Methylnaphthalene	mg/Kg	0.1	<0.1	<0.1
2-Chloronaphthalene	mg/Kg	0.1	<0.1	<0.1
Fluorene	mg/Kg	0.1	<0.1	<0.1
Phenanthrene	mg/Kg	0.1	<0.1	<0.1
Anthracene	mg/Kg	0.1	<0.1	<0.1
Fluoranthene	mg/Kg	0.1	<0.1	<0.1
Pyrene	mg/Kg	0.1	<0.1	<0.1
Benzo(a)anthracene	mg/Kg	0.1	<0.1	<0.1
Chrysene	mg/Kg	0.1	<0.1	<0.1
Benzo(b)fluoranthene	mg/Kg	0.1	<0.1	<0.1
Benzo(k)fluoranthene	mg/Kg	0.1	<0.1	<0.1
Benzo(a)pyrene	mg/Kg	0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	mg/Kg	0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/Kg	0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/Kg	0.1	<0.1	<0.1
Di-n-butylphthalate	mg/Kg	0.1	<0.1	<0.1
Bis(2-ethylhexyl)phthalate	mg/Kg	0.5	<0.5	<0.5
N-Nitrosodi-n-propylamine	mg/Kg	0.1	<0.1	<0.1
Diphenylamine&N-Nitrosodiphenylamine	mg/Kg	0.1	<0.1	<0.1

		Sample Number	14-00690.036	14-00690.037
		Sample Name	9#	10#
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/03/18	2014/03/18
Parameter	Units	LOR		

Appendix D SVOCs Method: HJ 350-2007 Appendix D (continued)

Parameter	Units	LOR	14-00690.036	14-00690.037
Nitrobenzene	mg/Kg	0.1	<0.1	<0.1
2,4-Dinitrotoluene	mg/Kg	0.1	<0.1	<0.1
Bis(2-chloroisopropyl)ether	mg/Kg	0.5	<0.5	<0.5
1,3-Dichlorobenzene	mg/Kg	0.1	<0.1	<0.1
1,4-Dichlorobenzene	mg/Kg	0.1	<0.1	<0.1
1,2-Dichlorobenzene	mg/Kg	0.1	<0.1	<0.1
Hexachloroethane	mg/Kg	0.1	<0.1	<0.1
1,2,4-Trichlorobenzene	mg/Kg	0.1	<0.1	<0.1
Hexachlorobutadiene	mg/Kg	0.1	<0.1	<0.1
Hexachlorobenzene	mg/Kg	0.1	<0.1	<0.1
1,3,5-Trimethylbenzene	mg/Kg	0.1	<0.1	<0.1
1,2,4-Trimethylbenzene	mg/Kg	0.1	<0.1	<0.1
Aniline	mg/Kg	0.5	<0.5	<0.5
4-Chloroaniline	mg/Kg	0.1	<0.1	<0.1
Carbazole	mg/Kg	0.1	<0.1	<0.1
Benzidine	mg/Kg	0.1	<0.1	<0.1
3,3-Dichlorobenzidine*	mg/Kg	0.1	<0.1	<0.1

		Sample Number	14-00690.011	14-00690.012	14-00690.013
		Sample Name	9#-2	9#-3	9#-4
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

Parameter	Units	LOR	14-00690.011	14-00690.012	14-00690.013
SURROGATES					
Tetrachloro-m-xylene	%	-	61	58	72
Decachlorobiphenyl	%	-	96	77	83
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	<0.01	<0.01	**1.53**
γ-BHC	mg/Kg	0.01	**0.01**	<0.01	**0.55**
β-BHC	mg/Kg	0.01	**0.08**	<0.01	**0.51**
Heptachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01	**0.03**
Aldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01

		Sample Number Sample Name Sample Matrix Sample Description Receive Date	14-00690.011 9#-2 Soil - 2014/03/18	14-00690.012 9#-3 Soil - 2014/03/18	14-00690.013 9#-4 Soil - 2014/03/18
Parameter	Units	LOR			
OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)					
Endosulfan I	mg/Kg	0.01	<0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	<0.01	**0.01**
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01	<0.01

		Sample Number Sample Name Sample Matrix Sample Description Receive Date	14-00690.014 9#-5 Soil - 2014/03/18	14-00690.016 10#-2 Soil - 2014/03/18	14-00690.017 10#-3 Soil - 2014/03/18
Parameter	Units	LOR			
OCP in soil GC-ECD Method: HJ 350-2007 Appendix G					
SURROGATES					
Tetrachloro-m-xylene	%	-	70	56	49
Decachlorobiphenyl	%	-	75	83	75
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	**0.03**	<0.01	<0.01
γ-BHC	mg/Kg	0.01	**0.01**	<0.01	<0.01
β-BHC	mg/Kg	0.01	**0.03**	**0.10**	**0.02**
Heptachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01	<0.01

Parameter	Units	LOR	14-00690.014	14-00690.016	14-00690.017
Sample Number			14-00690.014	14-00690.016	14-00690.017
Sample Name			9#-5	10#-2	10#-3
Sample Matrix			Soil	Soil	Soil
Sample Description			-	-	-
Receive Date			2014/03/18	2014/03/18	2014/03/18

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

Parameter	Units	LOR	14-00690.014	14-00690.016	14-00690.017
α-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	**0.02**	<0.01
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01	<0.01

Parameter	Units	LOR	14-00690.018	14-00690.019	14-00690.021
Sample Number			14-00690.018	14-00690.019	14-00690.021
Sample Name			10#-4	10#-5	11#-2
Sample Matrix			Soil	Soil	Soil
Sample Description			-	-	-
Receive Date			2014/03/18	2014/03/18	2014/03/18

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

Parameter	Units	LOR	14-00690.018	14-00690.019	14-00690.021
SURROGATES					
Tetrachloro-m-xylene	%	-	53	68	-
Decachlorobiphenyl	%	-	72	70	-
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	<0.01	<0.01	**0.39**
γ-BHC	mg/Kg	0.01	<0.01	<0.01	**0.11**
β-BHC	mg/Kg	0.01	**0.01**	<0.01	**0.05**
Heptachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01	**0.03**
Aldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01

Parameter	Units	LOR	14-00690.018	14-00690.019	14-00690.021
Sample Number			14-00690.018	14-00690.019	14-00690.021
Sample Name			10#-4	10#-5	11#-2
Sample Matrix			Soil	Soil	Soil
Sample Description			-	-	-
Receive Date			2014/03/18	2014/03/18	2014/03/18

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

Parameter	Units	LOR	14-00690.018	14-00690.019	14-00690.021
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	**0.01**	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	**0.01**	<0.01	<0.01
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01	<0.01

Parameter	Units	LOR	14-00690.022	14-00690.023	14-00690.024
Sample Number			14-00690.022	14-00690.023	14-00690.024
Sample Name			11#-3	11#-4	11#-5
Sample Matrix			Soil	Soil	Soil
Sample Description			-	-	-
Receive Date			2014/03/18	2014/03/18	2014/03/18

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

Parameter	Units	LOR	14-00690.022	14-00690.023	14-00690.024
SURROGATES					
Tetrachloro-m-xylene	%	-	58	65	61
Decachlorobiphenyl	%	-	75	85	96
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
β-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
Heptachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01

Parameter	Units	LOR	14-00690.022	14-00690.023	14-00690.024
Sample Number			14-00690.022	14-00690.023	14-00690.024
Sample Name			11#-3	11#-4	11#-5
Sample Matrix			Soil	Soil	Soil
Sample Description			-	-	-
Receive Date			2014/03/18	2014/03/18	2014/03/18

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

Parameter	Units	LOR	14-00690.022	14-00690.023	14-00690.024
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01	<0.01

Parameter	Units	LOR	14-00690.025	14-00690.026	14-00690.027
Sample Number			14-00690.025	14-00690.026	14-00690.027
Sample Name			12#-1	12#-2	12#-3
Sample Matrix			Soil	Soil	Soil
Sample Description			-	-	-
Receive Date			2014/03/18	2014/03/18	2014/03/18

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

Parameter	Units	LOR	14-00690.025	14-00690.026	14-00690.027
SURROGATES					
Tetrachloro-m-xylene	%	-	65	60	68
Decachlorobiphenyl	%	-	80	77	83
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	**0.06**	<0.01	<0.01
γ-BHC	mg/Kg	0.01	**0.07**	<0.01	<0.01
β-BHC	mg/Kg	0.01	**0.28**	<0.01	<0.01
Heptachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	**0.06**	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01

		Sample Number	14-00690.025	14-00690.026	14-00690.027
		Sample Name	12#-1	12#-2	12#-3
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

Dieldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01	<0.01

		Sample Number	14-00690.028	14-00690.029	14-00690.030
		Sample Name	13#-1	13#-2	13#-3
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES					
Tetrachloro-m-xylene	%	-	61	59	70
Decachlorobiphenyl	%	-	71	72	75
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	**0.02**	<0.01	<0.01
γ-BHC	mg/Kg	0.01	**0.01**	<0.01	<0.01
β-BHC	mg/Kg	0.01	**0.03**	<0.01	<0.01
Heptachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01	<0.01

Parameter	Units	LOR	14-00690.028 13#-1 Soil - 2014/03/18	14-00690.029 13#-2 Soil - 2014/03/18	14-00690.030 13#-3 Soil - 2014/03/18
Sample Number / Sample Name / Sample Matrix / Sample Description / Receive Date					

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

o,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01	<0.01

Parameter	Units	LOR	14-00690.031 14#-1 Soil - 2014/03/18	14-00690.032 14#-2 Soil - 2014/03/18	14-00690.033 14#-3 Soil - 2014/03/18
Sample Number / Sample Name / Sample Matrix / Sample Description / Receive Date					

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES					
Tetrachloro-m-xylene	%	-	65	70	61
Decachlorobiphenyl	%	-	75	77	75
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	**0.29**	**0.05**	<0.01
γ-BHC	mg/Kg	0.01	**0.19**	**0.02**	<0.01
β-BHC	mg/Kg	0.01	**0.13**	<0.01	<0.01
Heptachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	**0.08**	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01

Parameter	Units	LOR	14-00690.031 14#-1 Soil - 2014/03/18	14-00690.032 14#-2 Soil - 2014/03/18	14-00690.033 14#-3 Soil - 2014/03/18
Sample Number Sample Name Sample Matrix Sample Description Receive Date					

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

Endrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01	<0.01

Parameter	Units	LOR	14-00690.034 15#-2 Soil - 2014/03/18	14-00690.035 17# Soil - 2014/03/18	14-00690.039 15#-1 Soil - 2014/03/18
Sample Number Sample Name Sample Matrix Sample Description Receive Date					

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES					
Tetrachloro-m-xylene	%	-	59	86	84
Decachlorobiphenyl	%	-	71	82	108
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	<0.01	**0.79**	<0.01
γ-BHC	mg/Kg	0.01	<0.01	**0.17**	<0.01
β-BHC	mg/Kg	0.01	<0.01	**5.35**	<0.01
Heptachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	**0.17**	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	**0.13**	**0.02**
Dieldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01	<0.01

		Sample Number	14-00690.034	14-00690.035	14-00690.039
		Sample Name	15#-2	17#	15#-1
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	**0.28**	<0.01
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01	<0.01

		Sample Number	14-00690.040	14-00690.041	14-00690.042
		Sample Name	16#-1	16#-2	对照样品
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES					
Tetrachloro-m-xylene	%	-	88	82	89
Decachlorobiphenyl	%	-	86	106	90
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	**0.02**	**0.02**	<0.01
γ-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
β-BHC	mg/Kg	0.01	**0.53**	**0.37**	<0.01
Heptachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	**0.54**	**0.53**	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	**0.08**	**0.07**	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01

Parameter	Units	LOR	Sample Number Sample Name Sample Matrix Sample Description Receive Date	14-00690.040 16#-1 Soil - 2014/03/18	14-00690.041 16#-2 Soil - 2014/03/18	14-00690.042 对照样品 Soil - 2014/03/18
OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)						
p,p'-DDD	mg/Kg	0.01		**0.10**	**0.10**	<0.01
o,p'-DDT	mg/Kg	0.01		**0.08**	**0.08**	<0.01
Endosulfan II	mg/Kg	0.01		<0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01		**0.18**	**0.19**	<0.01
Endrin aldehyde	mg/Kg	0.01		<0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01		<0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01		<0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01		<0.01	<0.01	<0.01

Parameter	Units	LOR	14-00690.036	14-00690.037
Sample Number			14-00690.036	14-00690.037
Sample Name			9#	10#
Sample Matrix			Soil	Soil
Sample Description			-	-
Receive Date			2014/03/18	2014/03/18

VOCs in soil GC-MS Method: HJ 350-2007 Appendix C

Parameter	Units	LOR	14-00690.036	14-00690.037
SURROGATES				
Toluene-d8	%	-	100	100
4-Bromofluorobenzene	%	-	98	98
Dibromofluoromethane	%	-	101	102
VOCs				
Benzene	mg/Kg	0.05	<0.05	<0.05
Toluene	mg/Kg	0.05	<0.05	<0.05
Ethylbenzene	mg/Kg	0.05	<0.05	<0.05
meta&para-Xylene	mg/Kg	0.05	<0.05	<0.05
Styrene	mg/Kg	0.05	<0.05	<0.05
ortho-Xylene	mg/Kg	0.05	<0.05	<0.05
Xylene	mg/Kg	0.10	<0.10	<0.10
1,2-Dichloropropane	mg/Kg	0.05	<0.05	<0.05
1,1-Dichloroethene	mg/Kg	0.5	<0.5	<0.5
Methylene chloride	mg/Kg	0.5	<0.5	<0.5
1,2-Dichloroethene	mg/Kg	0.10	<0.10	<0.10
trans-1,2-Dichloroethene	mg/Kg	0.05	<0.05	<0.05
1,1-Dichloroethane	mg/Kg	0.05	<0.05	<0.05
cis-1,2-Dichloroethene	mg/Kg	0.05	<0.05	<0.05
1,1,1-trichloroethane	mg/Kg	0.05	<0.05	<0.05
Carbon tetrachloride	mg/Kg	0.05	<0.05	<0.05
1,2-Dichloroethane	mg/Kg	0.05	<0.05	<0.05
Trichloroethene	mg/Kg	0.05	<0.05	<0.05
1,1,2-Trichloroethane	mg/Kg	0.05	<0.05	<0.05
Tetrachloroethene	mg/Kg	0.05	<0.05	<0.05
1,1,1,2-Tetrachloroethane	mg/Kg	0.05	<0.05	<0.05
1,1,2,2-Tetrachloroethane	mg/Kg	0.05	<0.05	<0.05
1,2,3-Trichloropropane	mg/Kg	0.05	<0.05	<0.05
Chlorobenzene	mg/Kg	0.05	<0.05	<0.05
Chloroform	mg/Kg	0.05	<0.05	<0.05
Bromodichloromethane	mg/Kg	0.05	<0.05	<0.05
Dibromochloromethane	mg/Kg	0.05	<0.05	<0.05
Bromoform	mg/Kg	0.05	<0.05	<0.05

			14-00690.002	14-00690.003	14-00690.004
		Sample Number	14-00690.002	14-00690.003	14-00690.004
		Sample Name	1#	2#	3#
		Sample Matrix	Solid	Solid	Solid
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			
Soil. Determination of dry matter and water content. Gravimetric method			**Method: HJ 613-2011**		
Dry weight	%	-	86.5	90.7	91.5

		Sample Number	14-00690.005	14-00690.006	14-00690.007
		Sample Name	4#	5#	6#
		Sample Matrix	Solid	Solid	Solid
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			
Soil. Determination of dry matter and water content. Gravimetric method			**Method: HJ 613-2011**		
Dry weight	%	-	95.0	84.7	81.6

		Sample Number	14-00690.008	14-00690.009	14-00690.010
		Sample Name	7#	8#	9#-1
		Sample Matrix	Solid	Solid	Solid
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			
Soil. Determination of dry matter and water content. Gravimetric method			**Method: HJ 613-2011**		
Dry weight	%	-	86.7	85.0	72.3

		Sample Number	14-00690.015	14-00690.020
		Sample Name	10#-1	11#-1
		Sample Matrix	Solid	Solid
		Sample Description	-	-
		Receive Date	2014/03/18	2014/03/18
Parameter	Units	LOR		
Soil. Determination of dry matter and water content. Gravimetric method			**Method: HJ 613-2011**	
Dry weight	%	-	75.3	79.1

		Sample Number	14-00690.002	14-00690.003	14-00690.004
		Sample Name	1#	2#	3#
		Sample Matrix	Solid	Solid	Solid
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES					
Tetrachloro-m-xylene	%	-	58	61	72
Decachlorobiphenyl	%	-	80	82	-
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
β-BHC	mg/Kg	0.01	<0.01	**0.02**	**0.05**
Heptachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01	**0.01**
Dieldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	**0.01**	**0.02**
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01	<0.01

		Sample Number	14-00690.005	14-00690.006	14-00690.007
		Sample Name	4#	5#	6#
		Sample Matrix	Solid	Solid	Solid
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES					
Tetrachloro-m-xylene	%	-	-	64	52
Decachlorobiphenyl	%	-	-	89	91
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	**<0.10↑**	**0.02**	**0.02**
γ-BHC	mg/Kg	0.01	**<0.10↑**	<0.01	**0.01**
β-BHC	mg/Kg	0.01	**<0.10↑**	**1.83**	**0.29**
Heptachlor	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01
δ-BHC	mg/Kg	0.01	**<0.10↑**	**0.04**	**0.02**
Aldrin	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	**<0.10↑**	**0.02**	**0.01**
p,p'-DDE	mg/Kg	0.01	**<0.10↑**	**0.05**	<0.01
Dieldrin	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01
Endrin	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	**<0.10↑**	**0.11**	<0.01
Endosulfan II	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	**<0.10↑**	**0.04**	**0.03**
Endrin aldehyde	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	**<0.10↑**	<0.01	<0.01

		Sample Number	14-00690.008	14-00690.009	14-00690.010
		Sample Name	7#	8#	9#-1
		Sample Matrix	Solid	Solid	Solid
		Sample Description	-	-	-
		Receive Date	2014/03/18	2014/03/18	2014/03/18
Parameter	Units	LOR			
OCP in soil GC-ECD Method: HJ 350-2007 Appendix G					
SURROGATES					
Tetrachloro-m-xylene	%	-	62	49	81
Decachlorobiphenyl	%	-	81	71	-
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	<0.01	<0.01	**0.05**
γ-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
β-BHC	mg/Kg	0.01	**0.07**	**0.01**	**0.35**
Heptachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01	**0.01**
Dieldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	<0.01	**0.01**
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01	<0.01

		Sample Number	14-00690.015	14-00690.020
		Sample Name	10#-1	11#-1
		Sample Matrix	Solid	Solid
		Sample Description	-	-
		Receive Date	2014/03/18	2014/03/18
Parameter	Units	LOR		

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES				
Tetrachloro-m-xylene	%	-	85	-
Decachlorobiphenyl	%	-	49	-
ORGANOCHLORINE PESTICIDES				
α-BHC	mg/Kg	0.01	<0.01	**0.13**
γ-BHC	mg/Kg	0.01	<0.01	**0.14**
β-BHC	mg/Kg	0.01	**0.04**	**2.33**
Heptachlor	mg/Kg	0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	**0.08**
Aldrin	mg/Kg	0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	**0.01**	**0.11**
Dieldrin	mg/Kg	0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	**0.43**
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01

Remark:

1):↑ : LOR values have been adjusted accordingly due to matrix interference.

*** End of Report ***

LB1402097			LB1402098		
DUP	MS	MSD	DUP	MS	MSD
QCO13-00259.003	QCO13-00259.003	QCO13-00259.003	QCO13-00356.011	QCO13-00356.011	QCO13-00356.011

LB1402192			LB1402232		
DUP	MS	MSD	DUP	MS	MSD
SHE14-00690.014	SHE14-00690.014	SHE14-00690.014	QCO14-00057.001	QCO14-00057.001	QCO14-00057.001

LB1402233			LB1402265		
DUP	MS	MSD	DUP	MS	MSD
QCO14-00058.001	QCO14-00058.001	QCO14-00058.001	SHE14-00690.034	SHE14-00690.034	SHE14-00690.034

LB1402278			LB1402279		
DUP	MS	MSD	DUP	MS	MSD
SHE14-00690.011	SHE14-00690.011	SHE14-00690.011	SHE14-00690.033	SHE14-00690.033	SHE14-00690.033

LB1402281			LB1402289
DUP	MS	MSD	DUP
QCO14-00060.001	QCO14-00060.001	QCO14-00060.001	SHE14-00690.011

LB1402290	LB1402510
DUP	DUP
SHE14-00690.033	SHE14-00690.039

LB1402741	LB1402781		
DUP	DUP	MS	MSD
SHE14-00690.001	SHE14-00690.001	SHE14-00690.001	SHE14-00690.001

MB blank results are compared to the Limit of Reporting

LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.

DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Metals ICP-MS Method: USEPA 200.8-1994

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Arsenic (As)	LB1402781	μg/L	5	<5	0%	103%	97%	3%
Lead (Pb)	LB1402781	μg/L	1	<1	0%	101%	94%	7%

Metals-Hg Method: USEPA 7473-1998

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Mercury (Hg)	LB1402741	μg/L	0.1	<0.1	0%	98%

OCP Method: USEPA 8081B-2007

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Tetrachloro-m-xylene	LB1402281	%	-	60%	0%	52%	53%	2%
Decachlorobiphenyl	LB1402281	%	-	109%	0%	92%	85%	6%
α-BHC	LB1402281	μg/L	0.1	<0.1	0%	111%	101%	3%

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

OCP Method: USEPA 8081B-2007 (continued)

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
γ-BHC	LB1402281	μg/L	0.1	<0.1	0%	105%	96%	4%
β-BHC	LB1402281	μg/L	0.1	<0.1	0%	115%	105%	6%
Heptachlor	LB1402281	μg/L	0.1	<0.1	0%	92%	86%	10%
δ-BHC	LB1402281	μg/L	0.1	<0.1	0%	122%	111%	8%
Aldrin	LB1402281	μg/L	0.1	<0.1	0%	82%	65%	12%
Heptachlor epoxide	LB1402281	μg/L	0.1	<0.1	0%	106%	97%	7%
γ-Chlordane	LB1402281	μg/L	0.1	<0.1	0%	101%	91%	9%
Trans-nonachlor	LB1402281	μg/L	0.1	<0.1	0%	104%	NA	NA
Endosulfan I	LB1402281	μg/L	0.1	<0.1	0%	106%	NA	NA
α-Chlordane	LB1402281	μg/L	0.1	<0.1	0%	99%	89%	9%
o,p'-DDE	LB1402281	μg/L	0.1	<0.1	0%	98%	NA	NA
p,p'-DDE	LB1402281	μg/L	0.1	<0.1	0%	109%	96%	11%
Dieldrin	LB1402281	μg/L	0.1	<0.1	0%	110%	99%	9%
o,p'-DDD	LB1402281	μg/L	0.1	<0.1	0%	115%	NA	NA
Endrin	LB1402281	μg/L	0.1	<0.1	0%	120%	123%	8%
Cis-Nonachlor	LB1402281	μg/L	0.1	<0.1	0%	105%	NA	NA
p,p'-DDD	LB1402281	μg/L	0.1	<0.1	0%	120%	132%	9%
o,p'-DDT	LB1402281	μg/L	0.1	<0.1	0%	104%	NA	NA
Endosulfan II	LB1402281	μg/L	0.1	<0.1	0%	119%	NA	NA
p,p'-DDT	LB1402281	μg/L	0.1	<0.1	0%	82%	73%	7%
Endrin aldehyde	LB1402281	μg/L	0.1	<0.1	0%	105%	NA	NA
Endosulfan sulfate	LB1402281	μg/L	0.1	<0.1	0%	113%	103%	11%
Methoxychlor	LB1402281	μg/L	0.1	<0.1	0%	98%	97%	7%
Endrin ketone	LB1402281	μg/L	0.1	<0.1	0%	115%	107%	10%

SVOCs Method: USEPA 8270D-2007

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
2-Fluorophenol	LB1402232	%	-	92%	1%	91%	49%	2%
Phenol-d6	LB1402232	%	-	70%	0%	73%	56%	13%
Nitrobenzene-d5	LB1402232	%	-	105%	1%	99%	58%	8%
2-Fluorobiphenyl	LB1402232	%	-	105%	2%	100%	48%	16%
2,4,6-Tribromophenol	LB1402232	%	-	99%	2%	100%	71%	3%
p-Terphenyl-d14	LB1402232	%	-	118%	1%	102%	77%	1%
Phenol	LB1402232	μg/L	0.5	<0.5	0%	68%	61%	3%
2-Chlorophenol	LB1402232	μg/L	0.5	<0.5	0%	98%	58%	3%
2-Methylphenol	LB1402232	μg/L	0.5	<0.5	0%	110%	NA	NA
3&4-Methylphenol	LB1402232	μg/L	0.5	<0.5	0%	92%	NA	NA
2-Nitrophenol	LB1402232	μg/L	0.5	<0.5	0%	82%	NA	NA
2,4-Dimethylphenol	LB1402232	μg/L	0.5	<0.5	0%	100%	NA	NA
2,4-Dichlorophenol	LB1402232	μg/L	0.5	<0.5	0%	104%	NA	NA
4-Chloro-3-methylphenol	LB1402232	μg/L	2.5	<2.5	0%	101%	56%	18%
2,6-Dichlorophenol	LB1402232	μg/L	0.5	<0.5	0%	84%	NA	NA
2,3,4,6-Tetrachlorophenol	LB1402232	μg/L	2.5	<2.5	0%	86%	NA	NA
2,4,6-Trichlorophenol	LB1402232	μg/L	0.5	<0.5	0%	116%	NA	NA

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

SVOCs Method: USEPA 8270D-2007 (continued)

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
2,4,5-Trichlorophenol	LB1402232	µg/L	0.5	<0.5	0%	104%	NA	NA
2,4-Dinitrophenol	LB1402232	µg/L	2.5	<2.5	0%	77%	NA	NA
4-Nitrophenol	LB1402232	µg/L	2.5	<2.5	0%	92%	33%	1%
4,6-Dinitro-2-methylphenol	LB1402232	µg/L	2.5	<2.5	0%	113%	NA	NA
Pentachlorophenol	LB1402232	µg/L	2.5	<2.5	0%	113%	62%	2%
Naphthalene	LB1402232	µg/L	0.2	<0.2	0%	85%	NA	NA
2-Methylnaphthalene	LB1402232	µg/L	0.5	<0.5	0%	87%	NA	NA
2-Chloronaphthalene	LB1402232	µg/L	0.5	<0.5	0%	95%	NA	NA
Acenaphthylene	LB1402232	µg/L	0.2	<0.2	0%	96%	NA	NA
Acenaphthene	LB1402232	µg/L	0.2	<0.2	0%	97%	77%	4%
Fluorene	LB1402232	µg/L	0.2	<0.2	0%	103%	NA	NA
Phenanthrene	LB1402232	µg/L	0.2	<0.2	0%	93%	NA	NA
Anthracene	LB1402232	µg/L	0.2	<0.2	0%	98%	NA	NA
Fluoranthene	LB1402232	µg/L	0.2	<0.2	0%	94%	NA	NA
Pyrene	LB1402232	µg/L	0.2	<0.2	0%	95%	77%	1%
Benzo(a)anthracene	LB1402232	µg/L	0.2	<0.2	0%	101%	NA	NA
Chrysene	LB1402232	µg/L	0.2	<0.2	0%	95%	NA	NA
7,12-Dimethylbenz(a)anthracene	LB1402232	µg/L	0.5	<0.5	0%	89%	NA	NA
Benzo(b)fluoranthene	LB1402232	µg/L	0.05	<0.05	0%	104%	NA	NA
Benzo(k)fluoranthene	LB1402232	µg/L	0.05	<0.05	0%	98%	NA	NA
Benzo(a)pyrene	LB1402232	µg/L	0.05	<0.05	0%	98%	NA	NA
Indeno(1,2,3-cd)pyrene	LB1402232	µg/L	0.05	<0.05	0%	96%	NA	NA
Dibenzo(a,h)anthracene	LB1402232	µg/L	0.2	<0.2	0%	96%	NA	NA
Benzo(g,h,i)perylene	LB1402232	µg/L	0.05	<0.05	0%	88%	NA	NA
Dimethylphthalate	LB1402232	µg/L	0.5	<0.5	0%	102%	NA	NA
Diethylphthalate	LB1402232	µg/L	0.5	<0.5	0%	100%	NA	NA
Di-n-butylphthalate	LB1402232	µg/L	0.5	<0.5	0%	102%	NA	NA
Butyl benzyl phthalate	LB1402232	µg/L	0.5	<0.5	0%	102%	NA	NA
Bis(2-ethylhexyl)phthalate	LB1402232	µg/L	2.5	<2.5	0%	109%	NA	NA
Di-n-octylphthalate	LB1402232	µg/L	0.5	<0.5	0%	109%	NA	NA
N-Nitrosodimethylamine	LB1402232	µg/L	0.5	<0.5	0%	63%	NA	NA
N-Nitrosodi-n-propylamine	LB1402232	µg/L	0.5	<0.5	0%	95%	74%	1%
N-Nitrosomethylethylamine	LB1402232	µg/L	2.5	<2.5	0%	80%	NA	NA
N-Nitrosodiethylamine	LB1402232	µg/L	0.5	<0.5	0%	66%	NA	NA
N-Nitrosopiperidine	LB1402232	µg/L	0.5	<0.5	0%	78%	NA	NA
N-Nitrosomorpholine	LB1402232	µg/L	0.5	<0.5	0%	73%	NA	NA
N-Nitrosodi-n-butylamine	LB1402232	µg/L	0.5	<0.5	0%	83%	NA	NA
Diphenylamine&N-Nitrosodiphenylamine	LB1402232	µg/L	0.5	<0.5	0%	79%	NA	NA
Methapyrilene	LB1402232	µg/L	2.5	<2.5	0%	80%	NA	NA
Acetophenone	LB1402232	µg/L	0.5	<0.5	0%	87%	NA	NA
Nitrobenzene	LB1402232	µg/L	0.5	<0.5	0%	94%	NA	NA
Isophorone	LB1402232	µg/L	0.5	<0.5	0%	88%	NA	NA
1,3-Dinitrobenzene	LB1402232	µg/L	2.5	<2.5	0%	100%	NA	NA
1-Naphthylamine	LB1402232	µg/L	0.5	<0.5	0%	80%	NA	NA
2-Naphthylamine	LB1402232	µg/L	0.5	<0.5	0%	21%	NA	NA

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

SVOCs **Method: USEPA 8270D-2007 (continued)**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
2,6-Dinitrotoluene	LB1402232	µg/L	0.5	<0.5	0%	95%	NA	NA
2,4-Dinitrotoluene	LB1402232	µg/L	0.5	<0.5	0%	90%	70%	6%
1,3,5-Trinitrobenzene	LB1402232	µg/L	0.5	<0.5	0%	84%	NA	NA
Pentachloronitrobenzene	LB1402232	µg/L	0.5	<0.5	0%	92%	NA	NA
5-Nitro-o-toluidine	LB1402232	µg/L	0.5	<0.5	0%	100%	NA	NA
Phenacetin	LB1402232	µg/L	0.5	<0.5	0%	128%	NA	NA
4-Aminobiphenyl	LB1402232	µg/L	0.5	<0.5	0%	81%	NA	NA
Azobenzene	LB1402232	µg/L	0.5	<0.5	0%	91%	NA	NA
Propyzamide	LB1402232	µg/L	0.5	<0.5	0%	93%	NA	NA
P-Dimethylaminoazobenzene	LB1402232	µg/L	0.5	<0.5	0%	105%	NA	NA
Bis(2-chloroethyl) ether	LB1402232	µg/L	2.5	<2.5	0%	95%	NA	NA
Bis(2-chloroisopropyl)ether	LB1402232	µg/L	2.5	<2.5	0%	77%	NA	NA
Bis(2-chloroethoxy) methane	LB1402232	µg/L	2.5	<2.5	0%	96%	NA	NA
4-Chlorophenyl phenyl ether	LB1402232	µg/L	2.5	<2.5	0%	106%	NA	NA
4-Bromophenyl phenyl ether	LB1402232	µg/L	2.5	<2.5	0%	100%	NA	NA
1,3-Dichlorobenzene	LB1402232	µg/L	0.5	<0.5	0%	80%	NA	NA
1,4-Dichlorobenzene	LB1402232	µg/L	0.5	<0.5	0%	81%	86%	7%
1,2-Dichlorobenzene	LB1402232	µg/L	0.5	<0.5	0%	80%	NA	NA
Hexachloroethane	LB1402232	µg/L	0.5	<0.5	0%	74%	NA	NA
Pentachloroethane	LB1402232	µg/L	0.5	<0.5	0%	74%	NA	NA
1,3,5-Trichlorobenzene	LB1402232	µg/L	0.5	<0.5	0%	74%	NA	NA
1,2,4-Trichlorobenzene	LB1402232	µg/L	0.5	<0.5	0%	83%	87%	1%
Hexachlorobutadiene	LB1402232	µg/L	0.5	<0.5	0%	77%	NA	NA
Hexachloropropene	LB1402232	µg/L	0.5	<0.5	0%	80%	NA	NA
Hexachlorocyclopentadiene	LB1402232	µg/L	2.5	<2.5	0%	98%	NA	NA
Pentachlorobenzene	LB1402232	µg/L	0.5	<0.5	0%	80%	NA	NA
1,2,4,5-Tetrachlorobenzene	LB1402232	µg/L	0.5	<0.5	0%	80%	NA	NA
Hexachlorobenzene	LB1402232	µg/L	0.5	<0.5	0%	94%	NA	NA
Aniline	LB1402232	µg/L	2.5	<2.5	0%	93%	NA	NA
o-Toluidine	LB1402232	µg/L	0.5	<0.5	0%	89%	NA	NA
4-Chloroaniline	LB1402232	µg/L	0.5	<0.5	0%	80%	NA	NA
2-Nitroaniline	LB1402232	µg/L	0.5	<0.5	0%	94%	NA	NA
3-Nitroaniline	LB1402232	µg/L	0.5	<0.5	0%	95%	NA	NA
Dibenzofuran	LB1402232	µg/L	0.5	<0.5	0%	100%	NA	NA
4-Nitroaniline	LB1402232	µg/L	0.5	<0.5	0%	82%	NA	NA
Carbazole	LB1402232	µg/L	0.5	<0.5	0%	86%	NA	NA

VOCs **Method: USEPA 8260C-2006**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Toluene-d8	LB1402098	%	-	99%	5%	99%	96%	17%
4-Bromofluorobenzene	LB1402098	%	-	98%	4%	100%	110%	7%
Dibromofluoromethane	LB1402098	%	-	103%	11%	100%	114%	2%
Benzene	LB1402098	µg/L	0.5	<0.5	0%	102%	103%	9%
Toluene	LB1402098	µg/L	0.5	<0.5	0%	100%	89%	20%
Ethylbenzene	LB1402098	µg/L	0.5	<0.5	0%	102%	NA	NA

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

VOCs Method: USEPA 8260C-2006 (continued)

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
meta&para-Xylene	LB1402098	µg/L	0.5	<0.5	0%	102%	NA	NA
Styrene	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA
ortho-Xylene	LB1402098	µg/L	0.5	<0.5	0%	100%	NA	NA
Isopropylbenzene	LB1402098	µg/L	0.5	<0.5	0%	102%	NA	NA
n-Propylbenzene	LB1402098	µg/L	0.5	<0.5	0%	104%	NA	NA
1,3,5-Trimethylbenzene	LB1402098	µg/L	0.5	<0.5	0%	102%	NA	NA
tert-butylbenzene	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA
1,2,4-Trimethylbenzene	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA
sec-Butylbenzene	LB1402098	µg/L	0.5	<0.5	0%	103%	NA	NA
p-Isopropyltoluene	LB1402098	µg/L	0.5	<0.5	0%	103%	NA	NA
n-Butylbenzene	LB1402098	µg/L	0.5	<0.5	0%	103%	NA	NA
2,2-Dichloropropane	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA
1,2-Dichloropropane	LB1402098	µg/L	0.5	<0.5	0%	102%	NA	NA
cis-1,3-Dichloropropene	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA
trans-1,3-Dichloropropene	LB1402098	µg/L	0.5	<0.5	0%	100%	NA	NA
1,2-Dibromoethane	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA
Dichlorodifluoromethane	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA
Chloromethane	LB1402098	µg/L	0.5	<0.5	0%	98%	NA	NA
Vinyl chloride	LB1402098	µg/L	0.5	<0.5	0%	107%	NA	NA
Bromomethane	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA
Chloroethane	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA
Trichlorofluoromethane	LB1402098	µg/L	0.5	<0.5	0%	104%	NA	NA
1,1-Dichloroethene	LB1402098	µg/L	0.5	<0.5	0%	100%	112%	4%
Methylene chloride	LB1402098	µg/L	5	<5	0%	93%	NA	NA
trans-1,2-Dichloroethene	LB1402098	µg/L	0.5	<0.5	0%	100%	NA	NA
1,1-Dichloroethane	LB1402098	µg/L	0.5	<0.5	0%	100%	NA	NA
cis-1,2-Dichloroethene	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA
Bromochloromethane	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA
1,1,1-trichloroethane	LB1402098	µg/L	0.5	<0.5	0%	98%	NA	NA
1,1-Dichloropropene	LB1402098	µg/L	0.5	<0.5	0%	102%	NA	NA
Carbon tetrachloride	LB1402098	µg/L	0.5	<0.5	0%	102%	NA	NA
1,2-Dichloroethane	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA
Trichloroethene	LB1402098	µg/L	0.5	<0.5	0%	101%	62%	5%
Dibromomethane	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA
1,1,2-Trichloroethane	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA
1,3-Dichloropropane	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA
Tetrachloroethene	LB1402098	µg/L	0.5	<0.5	0%	100%	NA	NA
1,1,1,2-Tetrachloroethane	LB1402098	µg/L	0.5	<0.5	0%	99%	NA	NA
1,1,2,2-Tetrachloroethane	LB1402098	µg/L	0.5	<0.5	0%	99%	NA	NA
1,2,3-Trichloropropane	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA
1,2-Dibromo-3-chloropropane	LB1402098	µg/L	0.5	<0.5	0%	102%	NA	NA
Hexachlorobutadiene	LB1402098	µg/L	0.5	<0.5	0%	99%	NA	NA
Chlorobenzene	LB1402098	µg/L	0.5	<0.5	4%	101%	101%	2%
Bromobenzene	LB1402098	µg/L	0.5	<0.5	0%	100%	NA	NA
2-Chlorotoluene	LB1402098	µg/L	0.5	<0.5	0%	101%	NA	NA

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

VOCs Method: USEPA 8260C-2006 (continued)

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
4-Chlorotoluene	LB1402098	μg/L	0.5	<0.5	0%	101%	NA	NA
1,3-Dichlorobenzene	LB1402098	μg/L	0.5	<0.5	0%	101%	NA	NA
1,4-Dichlorobenzene	LB1402098	μg/L	0.5	<0.5	0%	101%	NA	NA
1,2-Dichlorobenzene	LB1402098	μg/L	0.5	<0.5	0%	102%	NA	NA
1,2,4-Trichlorobenzene	LB1402098	μg/L	0.5	<0.5	0%	103%	NA	NA
1,2,3-Trichlorobenzene	LB1402098	μg/L	0.5	<0.5	0%	103%	NA	NA
Chloroform	LB1402098	μg/L	0.5	<0.5	0%	101%	NA	NA
Bromodichloromethane	LB1402098	μg/L	0.5	<0.5	0%	101%	NA	NA
Dibromochloromethane	LB1402098	μg/L	0.5	<0.5	0%	100%	NA	NA
Bromoform	LB1402098	μg/L	0.5	<0.5	0%	100%	NA	NA
Naphthalene	LB1402098	μg/L	0.5	<0.5	0%	104%	NA	NA

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Arsenic (As)	LB1402278	mg/Kg	0.5	<0.5	1%	94%	102%	0%
	LB1402279	mg/Kg	0.5	<0.5	16%	94%	102%	3%
Lead (Pb)	LB1402278	mg/Kg	0.1	<0.1	0%	100%	102%	10%
	LB1402279	mg/Kg	0.1	<0.1	3%	100%	100%	2%

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-1998

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Mercury (Hg)	LB1402289	mg/Kg	0.01	<0.01	3%	101%
	LB1402290	mg/Kg	0.01	<0.01	3%	103%
	LB1402510	mg/Kg	0.01	<0.01	7%	89%

Appendix D SVOCs Method: HJ 350-2007 Appendix D

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
2-Fluorophenol	LB1402233	%	-	102%	2%	95%	83%	11%
Phenol-d6	LB1402233	%	-	100%	12%	104%	91%	12%
Nitrobenzene-d5	LB1402233	%	-	103%	15%	95%	78%	9%
2-Fluorobiphenyl	LB1402233	%	-	110%	21%	95%	72%	2%

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Appendix D SVOCs Method: HJ 350-2007 Appendix D (continued)

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
2,4,6-Tribromophenol	LB1402233	%	-	81%	4%	112%	83%	6%
p-Terphenyl-d14	LB1402233	%	-	105%	10%	104%	79%	5%
2-Chlorophenol	LB1402233	mg/Kg	0.1	<0.1	0%	114%	93%	1%
2-Methylphenol	LB1402233	mg/Kg	0.1	<0.1	0%	109%	NA	NA
2-Nitrophenol	LB1402233	mg/Kg	0.1	<0.1	0%	106%	NA	NA
2,4-Dimethylphenol	LB1402233	mg/Kg	0.1	<0.1	0%	110%	NA	NA
2,4-Dichlorophenol	LB1402233	mg/Kg	0.1	<0.1	0%	119%	NA	NA
2,4,6-Trichlorophenol	LB1402233	mg/Kg	0.1	<0.1	0%	119%	NA	NA
2,4,5-Trichlorophenol	LB1402233	mg/Kg	0.1	<0.1	0%	112%	NA	NA
2,4-Dinitrophenol	LB1402233	mg/Kg	0.5	<0.5	0%	80%	NA	NA
4,6-Dinitro-2-methylphenol	LB1402233	mg/Kg	0.5	<0.5	0%	86%	NA	NA
Naphthalene	LB1402233	mg/Kg	0.1	<0.1	0%	103%	NA	NA
2-Methylnaphthalene	LB1402233	mg/Kg	0.1	<0.1	0%	103%	NA	NA
2-Chloronaphthalene	LB1402233	mg/Kg	0.1	<0.1	0%	112%	NA	NA
Fluorene	LB1402233	mg/Kg	0.1	<0.1	0%	105%	NA	NA
Phenanthrene	LB1402233	mg/Kg	0.1	<0.1	0%	107%	NA	NA
Anthracene	LB1402233	mg/Kg	0.1	<0.1	0%	105%	NA	NA
Fluoranthene	LB1402233	mg/Kg	0.1	<0.1	0%	108%	NA	NA
Pyrene	LB1402233	mg/Kg	0.1	<0.1	0%	125%	101%	9%
Benzo(a)anthracene	LB1402233	mg/Kg	0.1	<0.1	0%	108%	NA	NA
Chrysene	LB1402233	mg/Kg	0.1	<0.1	0%	108%	NA	NA
Benzo(b)fluoranthene	LB1402233	mg/Kg	0.1	<0.1	0%	95%	NA	NA
Benzo(k)fluoranthene	LB1402233	mg/Kg	0.1	<0.1	0%	93%	NA	NA
Benzo(a)pyrene	LB1402233	mg/Kg	0.1	<0.1	0%	109%	NA	NA
Indeno(1,2,3-cd)pyrene	LB1402233	mg/Kg	0.1	<0.1	0%	94%	NA	NA
Dibenzo(a,h)anthracene	LB1402233	mg/Kg	0.1	<0.1	0%	91%	NA	NA
Benzo(g,h,i)perylene	LB1402233	mg/Kg	0.1	<0.1	0%	87%	NA	NA
Di-n-butylphthalate	LB1402233	mg/Kg	0.1	<0.1	0%	87%	NA	NA
Bis(2-ethylhexyl)phthalate	LB1402233	mg/Kg	0.5	<0.5	0%	87%	NA	NA
N-Nitrosodi-n-propylamine	LB1402233	mg/Kg	0.1	<0.1	0%	108%	102%	15%
Diphenylamine&N-Nitrosodiphenylamine	LB1402233	mg/Kg	0.1	<0.1	0%	108%	NA	NA
Nitrobenzene	LB1402233	mg/Kg	0.1	<0.1	0%	110%	NA	NA
2,4-Dinitrotoluene	LB1402233	mg/Kg	0.1	<0.1	0%	127%	110%	13%
Bis(2-chloroisopropyl)ether	LB1402233	mg/Kg	0.5	<0.5	0%	96%	NA	NA
1,3-Dichlorobenzene	LB1402233	mg/Kg	0.1	<0.1	0%	105%	NA	NA
1,4-Dichlorobenzene	LB1402233	mg/Kg	0.1	<0.1	0%	105%	69%	1%
1,2-Dichlorobenzene	LB1402233	mg/Kg	0.1	<0.1	0%	106%	NA	NA
Hexachloroethane	LB1402233	mg/Kg	0.1	<0.1	0%	98%	NA	NA
1,2,4-Trichlorobenzene	LB1402233	mg/Kg	0.1	<0.1	0%	108%	80%	6%
Hexachlorobutadiene	LB1402233	mg/Kg	0.1	<0.1	0%	108%	NA	NA
Hexachlorobenzene	LB1402233	mg/Kg	0.1	<0.1	0%	115%	NA	NA
1,3,5-Trimethylbenzene	LB1402233	mg/Kg	0.1	<0.1	0%	99%	NA	NA
1,2,4-Trimethylbenzene	LB1402233	mg/Kg	0.1	<0.1	0%	100%	NA	NA
Aniline	LB1402233	mg/Kg	0.5	<0.5	0%	71%	NA	NA
4-Chloroaniline	LB1402233	mg/Kg	0.1	<0.1	0%	76%	NA	NA

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Appendix D SVOCs Method: HJ 350-2007 Appendix D (continued)

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Carbazole	LB1402233	mg/Kg	0.1	<0.1	0%	117%	NA	NA
Benzidine	LB1402233	mg/Kg	0.1	<0.1	0%	102%	NA	NA
3,3-Dichlorobenzidine	LB1402233	mg/Kg	0.1	<0.1	0%	106%	NA	NA

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Tetrachloro-m-xylene	LB1402192	%	-	77%	18%	75%	84%	2%
	LB1402265	%	-	77%	16%	73%	63%	13%
Decachlorobiphenyl	LB1402192	%	-	94%	11%	80%	92%	4%
	LB1402265	%	-	97%	10%	77%	74%	3%
α-BHC	LB1402192	mg/Kg	0.01	<0.01	8%	88%	57%	0%
	LB1402265	mg/Kg	0.01	<0.01	0%	82%	81%	2%
γ-BHC	LB1402192	mg/Kg	0.01	<0.01	16%	95%	73%	21%
	LB1402265	mg/Kg	0.01	<0.01	0%	89%	89%	3%
β-BHC	LB1402192	mg/Kg	0.01	<0.01	14%	88%	89%	25%
	LB1402265	mg/Kg	0.01	<0.01	0%	81%	89%	5%
Heptachlor	LB1402192	mg/Kg	0.01	<0.01	0%	125%	149%	30%
	LB1402265	mg/Kg	0.01	<0.01	0%	125%	125%	0%
δ-BHC	LB1402192	mg/Kg	0.01	<0.01	0%	93%	91%	1%
	LB1402265	mg/Kg	0.01	<0.01	0%	86%	86%	1%
Aldrin	LB1402192	mg/Kg	0.01	<0.01	0%	75%	80%	31%
	LB1402265	mg/Kg	0.01	<0.01	0%	71%	68%	3%
Heptachlor epoxide	LB1402192	mg/Kg	0.01	<0.01	0%	84%	101%	12%
	LB1402265	mg/Kg	0.01	<0.01	0%	78%	81%	1%
γ-Chlordane	LB1402192	mg/Kg	0.01	<0.01	0%	82%	89%	33%
	LB1402265	mg/Kg	0.01	<0.01	0%	77%	80%	2%
Trans-nonachlor	LB1402192	mg/Kg	0.01	<0.01	0%	86%	NA	NA
	LB1402265	mg/Kg	0.01	<0.01	0%	80%	NA	NA
Endosulfan I	LB1402192	mg/Kg	0.01	<0.01	0%	93%	NA	NA
	LB1402265	mg/Kg	0.01	<0.01	0%	87%	NA	NA
α-Chlordane	LB1402192	mg/Kg	0.01	<0.01	0%	81%	88%	32%
	LB1402265	mg/Kg	0.01	<0.01	0%	75%	79%	2%
o,p'-DDE	LB1402192	mg/Kg	0.01	<0.01	0%	79%	NA	NA
	LB1402265	mg/Kg	0.01	<0.01	0%	74%	NA	NA
p,p'-DDE	LB1402192	mg/Kg	0.01	<0.01	0%	81%	84%	19%
	LB1402265	mg/Kg	0.01	<0.01	0%	76%	81%	3%
Dieldrin	LB1402192	mg/Kg	0.01	<0.01	0%	87%	96%	18%
	LB1402265	mg/Kg	0.01	<0.01	0%	81%	86%	3%
o,p'-DDD	LB1402192	mg/Kg	0.01	<0.01	0%	87%	NA	NA
	LB1402265	mg/Kg	0.01	<0.01	0%	81%	NA	NA
Endrin	LB1402192	mg/Kg	0.01	<0.01	0%	119%	90%	5%
	LB1402265	mg/Kg	0.01	<0.01	0%	109%	114%	2%
Cis-Nonachlor	LB1402192	mg/Kg	0.01	<0.01	0%	87%	NA	NA
	LB1402265	mg/Kg	0.01	<0.01	0%	81%	NA	NA

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
p,p'-DDD	LB1402192	mg/Kg	0.01	<0.01	0%	109%	120%	34%
	LB1402265	mg/Kg	0.01	<0.01	0%	100%	105%	3%
o,p'-DDT	LB1402192	mg/Kg	0.01	<0.01	0%	100%	NA	NA
	LB1402265	mg/Kg	0.01	<0.01	0%	100%	NA	NA
Endosulfan II	LB1402192	mg/Kg	0.01	<0.01	0%	89%	NA	NA
	LB1402265	mg/Kg	0.01	<0.01	0%	82%	NA	NA
p,p'-DDT	LB1402192	mg/Kg	0.01	<0.01	0%	112%	85%	9%
	LB1402265	mg/Kg	0.01	<0.01	0%	105%	98%	2%
Endrin aldehyde	LB1402192	mg/Kg	0.01	<0.01	0%	89%	NA	NA
	LB1402265	mg/Kg	0.01	<0.01	0%	82%	NA	NA
Endosulfan sulfate	LB1402192	mg/Kg	0.01	<0.01	0%	96%	50%	4%
	LB1402265	mg/Kg	0.01	<0.01	0%	87%	50%	0%
Methoxychlor	LB1402192	mg/Kg	0.01	<0.01	0%	108%	125%	22%
	LB1402265	mg/Kg	0.01	<0.01	0%	112%	106%	1%
Endrin ketone	LB1402192	mg/Kg	0.01	<0.01	0%	101%	87%	10%
	LB1402265	mg/Kg	0.01	<0.01	0%	91%	60%	9%

VOCs in soil GC-MS Method: HJ 350-2007 Appendix C

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Toluene-d8	LB1402097	%	-	100%	2%	97%	95%	1%
4-Bromofluorobenzene	LB1402097	%	-	100%	1%	107%	81%	0%
Dibromofluoromethane	LB1402097	%	-	102%	11%	97%	96%	4%
Benzene	LB1402097	mg/Kg	0.05	<0.05	0%	97%	99%	3%
Toluene	LB1402097	mg/Kg	0.05	<0.05	0%	113%	95%	4%
Ethylbenzene	LB1402097	mg/Kg	0.05	<0.05	0%	88%	NA	NA
meta&para-Xylene	LB1402097	mg/Kg	0.05	<0.05	0%	93%	NA	NA
Styrene	LB1402097	mg/Kg	0.05	<0.05	0%	97%	NA	NA
ortho-Xylene	LB1402097	mg/Kg	0.05	<0.05	0%	95%	NA	NA
Xylene	LB1402097	mg/Kg	0.1	<0.10	0%	93%	NA	NA
1,2-Dichloropropane	LB1402097	mg/Kg	0.05	<0.05	0%	86%	NA	NA
1,1-Dichloroethene	LB1402097	mg/Kg	0.5	<0.5	0%	79%	107%	5%
Methylene chloride	LB1402097	mg/Kg	0.5	<0.5	0%	111%	NA	NA
1,2-Dichloroethene	LB1402097	mg/Kg	0.1	<0.10	0%	98%	NA	NA
trans-1,2-Dichloroethene	LB1402097	mg/Kg	0.05	<0.05	0%	88%	NA	NA
1,1-Dichloroethane	LB1402097	mg/Kg	0.05	<0.05	0%	100%	NA	NA
cis-1,2-Dichloroethene	LB1402097	mg/Kg	0.05	<0.05	0%	109%	NA	NA
1,1,1-trichloroethane	LB1402097	mg/Kg	0.05	<0.05	0%	102%	NA	NA
Carbon tetrachloride	LB1402097	mg/Kg	0.05	<0.05	0%	73%	NA	NA
1,2-Dichloroethane	LB1402097	mg/Kg	0.05	<0.05	0%	80%	NA	NA
Trichloroethene	LB1402097	mg/Kg	0.05	<0.05	0%	85%	127%	1%
1,1,2-Trichloroethane	LB1402097	mg/Kg	0.05	<0.05	0%	111%	NA	NA
Tetrachloroethene	LB1402097	mg/Kg	0.05	<0.05	0%	89%	NA	NA
1,1,1,2-Tetrachloroethane	LB1402097	mg/Kg	0.05	<0.05	0%	81%	NA	NA
1,1,2,2-Tetrachloroethane	LB1402097	mg/Kg	0.05	<0.05	0%	95%	NA	NA

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

VOCs in soil GC-MS Method: HJ 350-2007 Appendix C (continued)

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
1,2,3-Trichloropropane	LB1402097	mg/Kg	0.05	<0.05	0%	99%	NA	NA
Chlorobenzene	LB1402097	mg/Kg	0.05	<0.05	0%	83%	100%	4%
Chloroform	LB1402097	mg/Kg	0.05	<0.05	0%	110%	NA	NA
Bromodichloromethane	LB1402097	mg/Kg	0.05	<0.05	0%	103%	NA	NA
Dibromochloromethane	LB1402097	mg/Kg	0.05	<0.05	0%	95%	NA	NA
Bromoform	LB1402097	mg/Kg	0.05	<0.05	0%	84%	NA	NA

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Testing
CNAS L0599

TEST REPORT

CLIENT DETAILS

Contact	Xiaolong Zhu
Client	MANAGEMENT AND SERVICE CENTER FOR SOLID WASTES OF CHONGQING
Address	- CHINA
Telephone	-
Facsimile	-
Email	-
Order Number	-
Samples	Soil(20)
Project	**Gan Shui Site**

LABORATORY DETAILS

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Report Number	SHE14-02460 R0
SGS Reference	0000017774
Date Reported	2014/07/23

COMMENTS

1.This test document cannot be reproduced in any way, except in full content, without prior approval in writing by the laboratory.
2.The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

SIGNATORIES

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Testing Center Laboratory

Sample Number			14-02460.001	14-02460.002
Sample Name			17#-1	17#-2
Sample Matrix			Soil	Soil
Sample Description			-	-
Receive Date			2014/07/21	2014/07/21
Parameter	Units	LOR		

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	83.4	83.1

Sample Number			14-02460.001	14-02460.002
Sample Name			17#-1	17#-2
Sample Matrix			Soil	Soil
Sample Description			-	-
Receive Date			2014/07/21	2014/07/21
Parameter	Units	LOR		

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	4.2	3.7

Sample Number			14-02460.003	14-02460.004
Sample Name			18#-1	18#-2
Sample Matrix			Soil	Soil
Sample Description			-	-
Receive Date			2014/07/21	2014/07/21
Parameter	Units	LOR		

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	84.4	84.1

Sample Number			14-02460.003	14-02460.004
Sample Name			18#-1	18#-2
Sample Matrix			Soil	Soil
Sample Description			-	-
Receive Date			2014/07/21	2014/07/21
Parameter	Units	LOR		

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	4.5	4.5

			Sample Number	14-02460.005	14-02460.006
			Sample Name	18#-3	19#-1
			Sample Matrix	Soil	Soil
			Sample Description	-	-
			Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR			

Soil. Determination of dry matter and water content. Gravimetric method   Method: HJ 613-2011

Dry weight	%	-	85.2	85.1

			Sample Number	14-02460.005	14-02460.006
			Sample Name	18#-3	19#-1
			Sample Matrix	Soil	Soil
			Sample Description	-	-
			Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR			

Examination of pH in Soil and castoff   Method: USEPA 9045D-2004

pH	-	-	5.5	4.2

			Sample Number	14-02460.007	14-02460.008
			Sample Name	19#-2	20#-1
			Sample Matrix	Soil	Soil
			Sample Description	-	-
			Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR			

Soil. Determination of dry matter and water content. Gravimetric method   Method: HJ 613-2011

Dry weight	%	-	85.0	85.2

			Sample Number	14-02460.007	14-02460.008
			Sample Name	19#-2	20#-1
			Sample Matrix	Soil	Soil
			Sample Description	-	-
			Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR			

Examination of pH in Soil and castoff   Method: USEPA 9045D-2004

pH	-	-	4.2	4.8

		Sample Number	14-02460.009	14-02460.010
		Sample Name	20#-2	20#-3
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	86.7	84.9

		Sample Number	14-02460.009	14-02460.010
		Sample Name	20#-2	20#-3
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	4.1	3.8

		Sample Number	14-02460.011	14-02460.012
		Sample Name	21#-1	21#-2
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	82.8	84.4

		Sample Number	14-02460.011	14-02460.012
		Sample Name	21#-1	21#-2
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	4.4	4.2

		Sample Number	14-02460.013	14-02460.014
		Sample Name	21#-3	22#-1
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		
Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011				
Dry weight	%	-	84.5	81.0

		Sample Number	14-02460.013	14-02460.014
		Sample Name	21#-3	22#-1
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		
Examination of pH in Soil and castoff Method: USEPA 9045D-2004				
pH	-	-	4.0	4.1

		Sample Number	14-02460.015	14-02460.016
		Sample Name	22#-2	22#-3
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		
Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011				
Dry weight	%	-	82.7	78.8

		Sample Number	14-02460.015	14-02460.016
		Sample Name	22#-2	22#-3
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		
Examination of pH in Soil and castoff Method: USEPA 9045D-2004				
pH	-	-	3.6	3.5

		Sample Number	14-02460.017	14-02460.018
		Sample Name	23#-1	23#-2
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	82.9	82.2

		Sample Number	14-02460.017	14-02460.018
		Sample Name	23#-1	23#-2
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	4.5	3.9

		Sample Number	14-02460.019	14-02460.020
		Sample Name	23#-3	24#
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	83.8	82.4

		Sample Number	14-02460.019	14-02460.020
		Sample Name	23#-3	24#
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	3.9	4.3

		Sample Number	14-02460.001	14-02460.002
		Sample Name	17#-1	17#-2
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**8.6**	**2.6**
Lead (Pb)	mg/Kg	0.1	**22.7**	**15.1**

		Sample Number	14-02460.001	14-02460.002
		Sample Name	17#-1	17#-2
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-2007

Mercury (Hg)	mg/Kg	0.01	**0.50**	**0.22**

		Sample Number	14-02460.003	14-02460.004
		Sample Name	18#-1	18#-2
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**1.6**	**1.4**
Lead (Pb)	mg/Kg	0.1	**23.7**	**17.5**

		Sample Number	14-02460.003	14-02460.004
		Sample Name	18#-1	18#-2
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-2007

Mercury (Hg)	mg/Kg	0.01	**0.13**	**0.14**

		Sample Number	14-02460.005	14-02460.006
		Sample Name	18#-3	19#-1
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**1.9**	**1.4**
Lead (Pb)	mg/Kg	0.1	**21.3**	**18.3**

		Sample Number	14-02460.005	14-02460.006
		Sample Name	18#-3	19#-1
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-2007

Mercury (Hg)	mg/Kg	0.01	**0.07**	**0.12**

		Sample Number	14-02460.007	14-02460.008
		Sample Name	19#-2	20#-1
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**1.3**	**2.8**
Lead (Pb)	mg/Kg	0.1	**23.3**	**21.9**

		Sample Number	14-02460.007	14-02460.008
		Sample Name	19#-2	20#-1
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-2007

Mercury (Hg)	mg/Kg	0.01	**0.04**	**0.16**

Sample Number			14-02460.009	14-02460.010
Sample Name			20#-2	20#-3
Sample Matrix			Soil	Soil
Sample Description			-	-
Receive Date			2014/07/21	2014/07/21
Parameter	Units	LOR		

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**2.5**	**1.8**
Lead (Pb)	mg/Kg	0.1	**23.3**	**27.1**

Sample Number			14-02460.009	14-02460.010
Sample Name			20#-2	20#-3
Sample Matrix			Soil	Soil
Sample Description			-	-
Receive Date			2014/07/21	2014/07/21
Parameter	Units	LOR		

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-2007

Mercury (Hg)	mg/Kg	0.01	**0.08**	**0.17**

Sample Number			14-02460.011	14-02460.012
Sample Name			21#-1	21#-2
Sample Matrix			Soil	Soil
Sample Description			-	-
Receive Date			2014/07/21	2014/07/21
Parameter	Units	LOR		

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**1.5**	**3.7**
Lead (Pb)	mg/Kg	0.1	**35.7**	**27.5**

Sample Number			14-02460.011	14-02460.012
Sample Name			21#-1	21#-2
Sample Matrix			Soil	Soil
Sample Description			-	-
Receive Date			2014/07/21	2014/07/21
Parameter	Units	LOR		

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-2007

Mercury (Hg)	mg/Kg	0.01	**0.11**	**0.23**

		Sample Number	14-02460.013	14-02460.014
		Sample Name	21#-3	22#-1
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**1.1**	**1.4**
Lead (Pb)	mg/Kg	0.1	**13.0**	**30.8**

		Sample Number	14-02460.013	14-02460.014
		Sample Name	21#-3	22#-1
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-2007

Mercury (Hg)	mg/Kg	0.01	**0.07**	**0.11**

		Sample Number	14-02460.015	14-02460.016
		Sample Name	22#-2	22#-3
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**4.0**	**1.8**
Lead (Pb)	mg/Kg	0.1	**15.7**	**20.0**

		Sample Number	14-02460.015	14-02460.016
		Sample Name	22#-2	22#-3
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-2007

Mercury (Hg)	mg/Kg	0.01	**0.10**	**0.03**

		Sample Number	14-02460.017	14-02460.018
		Sample Name	23#-1	23#-2
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**1.7**	**1.5**
Lead (Pb)	mg/Kg	0.1	**17.4**	**25.7**

		Sample Number	14-02460.017	14-02460.018
		Sample Name	23#-1	23#-2
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-2007

Mercury (Hg)	mg/Kg	0.01	**0.15**	**0.22**

		Sample Number	14-02460.019	14-02460.020
		Sample Name	23#-3	24#
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**4.0**	**1.9**
Lead (Pb)	mg/Kg	0.1	**18.4**	**26.5**

		Sample Number	14-02460.019	14-02460.020
		Sample Name	23#-3	24#
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-2007

Mercury (Hg)	mg/Kg	0.01	**0.06**	**0.17**

		Sample Number	14-02460.001	14-02460.002
		Sample Name	17#-1	17#-2
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES				
Tetrachloro-m-xylene	%	-	72	71
Decachlorobiphenyl	%	-	77	79
ORGANOCHLORINE PESTICIDES				
α-BHC	mg/Kg	0.01	**0.16**	<0.01
γ-BHC	mg/Kg	0.01	**0.04**	<0.01
β-BHC	mg/Kg	0.01	<0.01	**0.01**
Heptachlor	mg/Kg	0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	<0.01
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01

		Sample Number	14-02460.003	14-02460.004
		Sample Name	18#-1	18#-2
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES				
Tetrachloro-m-xylene	%	-	81	75
Decachlorobiphenyl	%	-	87	75
ORGANOCHLORINE PESTICIDES				
α-BHC	mg/Kg	0.01	**0.02**	<0.01
γ-BHC	mg/Kg	0.01	<0.01	<0.01
β-BHC	mg/Kg	0.01	**0.01**	**0.01**
Heptachlor	mg/Kg	0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01

Parameter	Units	LOR		
		Sample Number	14-02460.003	14-02460.004
		Sample Name	18#-1	18#-2
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	<0.01
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01

Parameter	Units	LOR		
		Sample Number	14-02460.005	14-02460.006
		Sample Name	18#-3	19#-1
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES				
Tetrachloro-m-xylene	%	-	77	74
Decachlorobiphenyl	%	-	78	74
ORGANOCHLORINE PESTICIDES				
α-BHC	mg/Kg	0.01	<0.01	**0.06**
γ-BHC	mg/Kg	0.01	<0.01	**0.02**
β-BHC	mg/Kg	0.01	<0.01	**0.06**
Heptachlor	mg/Kg	0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01

		Sample Number	14-02460.005	14-02460.006
		Sample Name	18#-3	19#-1
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	<0.01
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01

		Sample Number	14-02460.007	14-02460.008
		Sample Name	19#-2	20#-1
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES				
Tetrachloro-m-xylene	%	-	71	70
Decachlorobiphenyl	%	-	73	71
ORGANOCHLORINE PESTICIDES				
α-BHC	mg/Kg	0.01	**0.02**	**0.13**
γ-BHC	mg/Kg	0.01	<0.01	**0.05**
β-BHC	mg/Kg	0.01	**0.03**	**0.05**
Heptachlor	mg/Kg	0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	**0.04**
Aldrin	mg/Kg	0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	**0.01**
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01

Parameter	Units	LOR		
		Sample Number	14-02460.009	14-02460.010
		Sample Name	20#-2	20#-3
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

Parameter	Units	LOR	14-02460.009	14-02460.010
SURROGATES				
Tetrachloro-m-xylene	%	-	78	72
Decachlorobiphenyl	%	-	73	74
ORGANOCHLORINE PESTICIDES				
α-BHC	mg/Kg	0.01	**0.04**	<0.01
γ-BHC	mg/Kg	0.01	**0.02**	<0.01
β-BHC	mg/Kg	0.01	**0.05**	<0.01
Heptachlor	mg/Kg	0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	**0.03**	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	<0.01
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01

Parameter	Units	LOR		
		Sample Number	14-02460.011	14-02460.012
		Sample Name	21#-1	21#-2
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

Parameter	Units	LOR	14-02460.011	14-02460.012
SURROGATES				
Tetrachloro-m-xylene	%	-	81	71
Decachlorobiphenyl	%	-	84	82
ORGANOCHLORINE PESTICIDES				
α-BHC	mg/Kg	0.01	**0.02**	<0.01
γ-BHC	mg/Kg	0.01	**0.02**	<0.01
β-BHC	mg/Kg	0.01	**0.07**	**0.02**
Heptachlor	mg/Kg	0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01

		Sample Number	14-02460.011	14-02460.012
		Sample Name	21#-1	21#-2
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

Parameter	Units	LOR	14-02460.011	14-02460.012
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	**0.03**	**0.03**
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01

		Sample Number	14-02460.013	14-02460.014
		Sample Name	21#-3	22#-1
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

Parameter	Units	LOR	14-02460.013	14-02460.014
SURROGATES				
Tetrachloro-m-xylene	%	-	71	72
Decachlorobiphenyl	%	-	76	81
ORGANOCHLORINE PESTICIDES				
α-BHC	mg/Kg	0.01	**0.02**	<0.01
γ-BHC	mg/Kg	0.01	<0.01	<0.01
β-BHC	mg/Kg	0.01	<0.01	<0.01
Heptachlor	mg/Kg	0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01

		Sample Number	14-02460.013	14-02460.014
		Sample Name	21#-3	22#-1
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	**0.03**	<0.01
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01

		Sample Number	14-02460.015	14-02460.016
		Sample Name	22#-2	22#-3
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES				
Tetrachloro-m-xylene	%	-	71	71
Decachlorobiphenyl	%	-	80	72
ORGANOCHLORINE PESTICIDES				
α-BHC	mg/Kg	0.01	<0.01	<0.01
γ-BHC	mg/Kg	0.01	<0.01	<0.01
β-BHC	mg/Kg	0.01	<0.01	<0.01
Heptachlor	mg/Kg	0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	**0.01**	<0.01
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01

		Sample Number	14-02460.017	14-02460.018
		Sample Name	23#-1	23#-2
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES				
Tetrachloro-m-xylene	%	-	70	72
Decachlorobiphenyl	%	-	78	81
ORGANOCHLORINE PESTICIDES				
α-BHC	mg/Kg	0.01	<0.01	<0.01
γ-BHC	mg/Kg	0.01	<0.01	<0.01
β-BHC	mg/Kg	0.01	<0.01	<0.01
Heptachlor	mg/Kg	0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	**0.02**	<0.01
o,p'-DDT	mg/Kg	0.01	**0.04**	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	**0.08**	**0.02**
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01

		Sample Number	14-02460.019	14-02460.020
		Sample Name	23#-3	24#
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2014/07/21	2014/07/21
Parameter	Units	LOR		

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES				
Tetrachloro-m-xylene	%	-	73	76
Decachlorobiphenyl	%	-	70	83
ORGANOCHLORINE PESTICIDES				
α-BHC	mg/Kg	0.01	<0.01	<0.01
γ-BHC	mg/Kg	0.01	<0.01	<0.01
β-BHC	mg/Kg	0.01	<0.01	**0.02**
Heptachlor	mg/Kg	0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01

Parameter	Units	LOR	14-02460.019	14-02460.020
Sample Number			14-02460.019	14-02460.020
Sample Name			23#-3	24#
Sample Matrix			Soil	Soil
Sample Description			-	-
Receive Date			2014/07/21	2014/07/21

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

Parameter	Units	LOR	14-02460.019	14-02460.020
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	<0.01	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	**0.07**
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01

*** End of Report ***

LB1407904			LB1407987		
DUP	MS	MSD	DUP	MS	MSD
SHE14-02460.006	SHE14-02460.006	SHE14-02460.006	SHE14-02460.001	SHE14-02460.001	SHE14-02460.001

LB1408021
DUP
SHE14-02460.001

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Appendix A Inductively coupled plasma-atomic emission spectrometry   Method: HJ 350-2007 Appendix A

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Arsenic (As)	LB1407987	mg/Kg	0.5	<0.5	0%	105%	96%	1%
Lead (Pb)	LB1407987	mg/Kg	0.1	<0.1	7%	92%	87%	8%

Mercury in solids and solutions by atomoc absorption spectrophotometry   Method: USEPA 7473-2007

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Mercury (Hg)	LB1408021	mg/Kg	0.01	<0.01	4%	98%

OCP in soil   GC-ECD   Method: HJ 350-2007 Appendix G

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Tetrachloro-m-xylene	LB1407904	%	-	73%	1%	77%	93%	19%
Decachlorobiphenyl	LB1407904	%	-	84%	11%	80%	78%	4%
α-BHC	LB1407904	mg/Kg	0.01	<0.01	16%	75%		
γ-BHC	LB1407904	mg/Kg	0.01	<0.01	19%	74%	74%	1%
β-BHC	LB1407904	mg/Kg	0.01	<0.01	17%	84%		
Heptachlor	LB1407904	mg/Kg	0.01	<0.01	0%	87%	89%	2%
δ-BHC	LB1407904	mg/Kg	0.01	<0.01	0%	70%	95%	23%
Aldrin	LB1407904	mg/Kg	0.01	<0.01	0%	71%	71%	0%
Heptachlor epoxide	LB1407904	mg/Kg	0.01	<0.01	0%	75%	77%	1%
γ-Chlordane	LB1407904	mg/Kg	0.01	<0.01	0%	74%	72%	1%
Trans-nonachlor	LB1407904	mg/Kg	0.01	<0.01	0%	75%	NA	NA
Endosulfan I	LB1407904	mg/Kg	0.01	<0.01	0%	77%	NA	NA
α-Chlordane	LB1407904	mg/Kg	0.01	<0.01	0%	75%	72%	2%
o,p'-DDE	LB1407904	mg/Kg	0.01	<0.01	0%	78%	NA	NA
p,p'-DDE	LB1407904	mg/Kg	0.01	<0.01	0%	83%	82%	3%
Dieldrin	LB1407904	mg/Kg	0.01	<0.01	0%	79%	80%	3%
o,p'-DDD	LB1407904	mg/Kg	0.01	<0.01	0%	81%	NA	NA
Endrin	LB1407904	mg/Kg	0.01	<0.01	0%	87%	86%	3%
Cis-Nonachlor	LB1407904	mg/Kg	0.01	<0.01	0%	84%	NA	NA
p,p'-DDD	LB1407904	mg/Kg	0.01	<0.01	0%	81%	90%	6%

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
o,p'-DDT	LB1407904	mg/Kg	0.01	<0.01	0%	91%	NA	NA
Endosulfan II	LB1407904	mg/Kg	0.01	<0.01	0%	71%	NA	NA
p,p'-DDT	LB1407904	mg/Kg	0.01	<0.01	0%	94%	74%	7%
Methoxychlor	LB1407904	mg/Kg	0.01	<0.01	0%	92%	104%	7%

SGS

SGS-CSTC 环境服务部

样 品 流 转 单

客户: Mangment and Service Center for solid Wastes of Chongqing

联系人: Zhu Xiaolong

地址/邮编:

电话:

传真:

项目名称: Gan Shui Site ([illegible])

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质控要求: □ 标准 □ 其它 (请注明)________

测试方法: □ USEPA □ GB □ APHA □ JIS □ 其它 (请注明)________

加盖CMA章: □ 是 □ 否 加盖CNAS章: □ 是 □ 否

SGS 项目号	SGS 报价号	应出报告日
SHE14-02460		7123

要求分析参数 (可加附件)

样品描述				介质				容器与保护剂										
客户样品号	SGS样品号	日期	时间	气体	液体	土壤/底泥	其他	Unpres.	HCl	HNO_3	H_2SO_4	NaOH		pH	Pb	Hg	As	OCPs
17#-1	1					✓								✓	✓	✓	✓	✓
17#-2	2					✓								✓	✓	✓	✓	✓
18#-1	3					✓								✓	✓	✓	✓	✓
18#-2	4	7.18				✓								✓	✓	✓	✓	✓
18#-3	5					✓								✓	✓	✓	✓	✓
19#-1	6					✓								✓	✓	✓	✓	✓
19#-2	7					✓								✓	✓	✓	✓	✓
20#-1	8					✓								✓	✓	✓	✓	✓
29#-2	9					✓								✓	✓	✓	✓	✓
20#-3	10					✓								✓	✓	✓	✓	✓
21#-1	11					✓								✓	✓	✓	✓	✓
21#-2	12					✓								✓	✓	✓	✓	✓

特别说明 /接收时条件
接收时温度: ________

□ 冷藏 ☑ 常温 □ 其它

测试周期要求: □ 10 个工作日 □ 7 个工作日 □ 5 个工作日 ☑ 其它 (请注明) 加急[illegible] 报告形式: ~~□ 中文~~ ☑ 英文 限值要求: ~~□ 是~~ □ 否

一个月后的样品处理: □ 归还客户 □ 由实验室处理 □ 保存__个月 (超过一个月后如需将样品归还客户, 将收取一定的费用) 样品

基质是否有毒有害: □ 有 □ 没有 备注: 如无特殊要求, 样品邮寄或客户直接送样过程的样品状态偏离为客户默认偏离.

样品送出
姓名: ________ 日期/时间: ________
姓名: ________ 日期/时间: ________
姓名: ________ 日期/时间: ________

样品接收
姓名: CW 日期/时间: 7121
姓名: ________ 日期/时间: ________
姓名: ________ 日期/时间: ________

备注: 所有SGS服务均遵循《服务通用条款》 http://www.sgs.com/terms_and_conditions.htm

Date effective: 03/01/2013

SGS

SGS-CSTC 环境服务部

[redacted]

样品流转单

[redacted]

客户:

联系人: Zhu Xiaolong

地址/邮编:

电话:

传真:

项目名称: Gan Shui ([illegible])

项目所在地:

电子版报告发送至:

文本报告寄送至:

质控要求: □ 标准 □ 其它 (请注明)

测试方法: □ USEPA □ GB □ APHA □ JIS □ 其它 (请注明)

加盖CMA 章: □ 是 □ 否 加盖CNAS 章: □ 是 □ 否

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要求分析参数 (可加附件)

特别说明 /接收时条件

接收时温度:

□ 冷藏 □ 常温 □ 其它

样品描述				介质				容器与保护剂						要求分析参数									特别说明 /接收时条件
客户样品号	SGS样品号	日期	时间	气体	液体	土壤/淤泥	其他	Unpres.	HCl	HNO_3	H_2SO_4	NaOH		pH	Pb	Hg	As	OCPs					
21#-3	13	7.18				✓								✓	✓	✓	✓	✓					
22#-1	14					✓								✓	✓	✓	✓	✓					
22#-2	15					✓								✓	✓	✓	✓	✓					
22#-3	16					✓								✓	✓	✓	✓	✓					
23#-1	17					✓								✓	✓	✓	✓	✓					
23#-2	18					✓								✓	✓	✓	✓	✓					
23#-3	19					✓								✓	✓	✓	✓	✓					
24#	20					✓								✓	✓	✓	✓	✓					

测试周期要求: □ 10 个工作日 □ 7个工作日 □5 个工作日 ☒其它 (请注明) 加急3个小时 报告形式: ☒中文 □英文 限值要求: ☒是 □否

一个月后的样品处理: □ 归还客户 □ 由实验室处理 □ 保存___个月 (超过一个月后如需将样品归还客户, 将收取一定的费用)

基质是否有毒有害: □有 □没有 备注: 如无特殊要求, 样品邮寄或客户直接送样过程的样品状态偏离为客户默认偏离.

样品

样品送出

姓名: Judy
日期/时间:
姓名:
日期/时间:
姓名:
日期/时间:

样品接收

姓名: CW.
日期/时间: 7.21
姓名:
日期/时间:
姓名:
日期/时间:

备注: 所有SGS服务均遵循《服务通用条款》 http://www.sgs.com/terms_and_conditions.htm

Date effective: 03/01/2013

ENV-SH-RCD-015-2.0

Scaffold Construction Design Plan

CNSWGD

Southwest Geotechnical & Design Institute of China Nuclear Industry

July 21, 2014

Scaffold Construction Design Plan

I. Project overview

This construction site is located at Nongzi Warehouse, Ganshui, Qijiang District, Chongqing.

II. Project purpose

1. The Nongzi Warehouse, Ganshui, Qijiang District, Chongqing is damaged, so it loses stability during the excavation, with upper half deforming, roof and rubble falling off. In order to ensure the safety operation, the scaffold and bamboo board are adopted to make sure the safety of workers.

2. Indoor foundation pit pile is fixed with scaffold during the construction.

3. The foundation of house is squared stone with the buried depth of about 0.3m-0.5m and that for foot section has deformed mark, therefore a safety protection distance should be left from the edge of foundation, i.e. about 1.5 m (according to the investigation, the buried depth of contaminated soils is 1.5 m), in order to produce no disturbance to the foundation during the excavation. The soil body is clay and the condensation height is about 2 m, so netch-jumping excavation and segmented tamping are adopted.

III. Adopted standards

Steel tubular scaffold is calculated according to the Technical Code for Safety of Steel Tubular Scaffold with Couplers in Construction (JGJ130-2001), Code for Design of Building Foundation (GB 50007-2002), Load Code for the Design of Building Structures (GB 50009-2001), Code for Design of Steel Structures (GB 50017-2003) and other codes.

IV. Construction preparations:

1. Steel tube

   1) The steel tube of scaffold is No. 3 welded steel tube with outer diameter of 48 mm and wall thickness of 3.5 mm, and its chemical composition and mechanical performance meet the national standard Carbon Structural Steel (GB/T700); the maximum length of transverse horizontal tube is 2,200 mm and that of other tubes is 6,500 mm, and the maximum mass of each steel tube should not be larger than 25 kg.

   2) The size and surface quality of steel tube should conform to the following regulations:

   ① A new steel tube should have quality certificate and quality inspection report; its surface should straight and smooth with no crack, scarring, layering, dislocation, hard bending, burring, indentation and deep scratch; the allowable deviation of steel tube is shown in the following table:

Table of Allowable Deviation of Steel Tube

S/N	Item	Allowable deviation	Inspection tool
1	Outer diameter of 48 mm and wall thickness of 3.5~3.0 (mm)		Vernier caliper
2	Oblique cutting deviation of two end surface of steel tube	1.7	Feeler gauge and corner ruler
3	Rust depth of outer surface of steel tube	≤0.50 mm	Vernier caliper
4	End bent of various member bars	L≤1.5m ≤5	Steel ruler
5	Upright tube bending	3m<l≤4m	
6	Steel tubes bent of horizontal tube and diagonal tube	L≤6.5m ≤30	

   ② It is prohibited to punch a hole on the steel tube.

2. Coupler:

   1) The steel tubular scaffold with couplers uses couplers made of malleable cast iron, and its materials should meet the regulations of current national standard Couplers of Steel Tubular Scaffold (GB15831); couplers made of other materials can be used only after the test shows that its quality meets the regulations of this standard. The faying surface of coupler and steel tube should have a good contact. When the coupler grips on the steel tube, the minimum distance at the opening should be smaller than 5 mm.

2) The couplers used for scaffold should not be damaged when the tightening torque of bolt reaches 6.5 N.M.

3. Foot plank

- Foot plank is square wood plank or bamboo plank, the mass of each plank should not be greater than 30 kg.
- The width is not smaller than 3 m, the length mustn’t be greater than 6 m, and the mesh should not be larger than 10 cm. The vinylon, chinlon, nylon and other materials must be used. It is prohibited to use damaged or rotten safety net and polypropylene net. The dense mesh safety net can only be used as vertical net.

4. Precautions

1). The component and fittings passing the inspection should be classified according to the variety and specification, and piled tidily and steadily. There should be no ponding in the stocking area.

2). Sundries of erection site should be removed to level the erection site and keep the slagging smooth.

V. Erection (refer to attached checking calculation for data)

1. The scaffold must be erected according to the construction schedule. An erection height should not exceed two steps (50cm) above adjacent connecting tube.

2. After a scaffold is erected each time, the step distance, longitudinal distance, horizontal distance and the verticality of upright tube should be corrected.

3. The placement of base should meet the following regulations:

1) The base and pad should be accurately placed on the position line;

2) The pad should be wooden pad with the length no smaller than 2 spans and the thickness no smaller than 500 mm or box iron.

4. The erection of upright tube should meet the following regulations:

1) It is prohibited to use steel tubes with the outer diameter of 48 mm and 51 mm together;

2) Except the lap joint can be used on the top layer and step to connect the upright tubes, joints of other layers and steps must be connected with butt coupler; the butt coupler of adjacent upright tubes mustn’t be within the same height and should meet the following regulations:

① Joints of two adjacent upright tubes should not be set within the same step, and the staggered distance in height of two adjacent joints of every upright tube within the same step is not smaller than 500 mm; the distance from each joint center to main contact should not be greater than 1/3 of step distance;

② The overlapping length should not be smaller than 1 m, and at least 2 rotary buckles should be used for fixation. The distance from the edge of end coupler coverplate to the tube end should not be smaller than 100 mm;

③ When the upright tube is started to be erected, a bracing should be set every 6 spans and can be dismantled only after the connecting tube is installed steadily.

5. The erection of longitudinal horizontal tube should meet the following regulations:

1) The longitudinal horizontal tube should be set at the inner side of upright tube, and its length should not be smaller than 3 spans;

2. The butt coupler should be used and the lap joint can also be adopted to connect the longitudinal horizontal tube.

6. The butt joint and lap joint should meet the following regulations:

1) The butt coupler of longitudinal horizontal tube should be in staggered arrangement, and the distance from each joint to the nearest main contact should not be greater than 1/3 of longitudinal distance.

2) The overlapping length should not be smaller than 1 m, and 3 rotary buckles should be set at equal interval for fixation. The distance from the edge of end coupler coverplate to the tube end should not be smaller than 100 mm.

3) The longitudinal horizontal tube should be taken as the support of transverse horizontal tube and fixed on the upright tube with right-angle coupler.

7. Within the same step of sealed scaffold, the longitudinal horizontal tube should be encircled and fixed with right-angle coupler and upright tube at internal and external angle.

8. The erection of transverse horizontal tube should meet the following regulations:

   1) The main contact must be set with a transverse horizontal tube and fastened with right-angle coupler, with dismantling prohibited. The center distance of two right-angle couplers at the main contact should not be greater than 150 mm.

   2) The transverse horizontal tube at non-main node on the operation level should be set according to the required equal interval to support foot plank, and the maximum interval should not be greater than 1/2 of longitudinal distance.

   3) The distance from one end against the wall of transverse horizontal tube of two-row scaffold to the decorative surface should not be greater than 100 mm.

9. The scaffold must be set with longitudinal and transverse bottom horizontal tubes.

   The longitudinal bottom horizontal tube should be fixed on the upright tube at the place no greater than 200 mm from base epithelium with right-angle coupler. The transverse bottom horizontal tube should also be fixed on the upright tube adjoining the lower part of longitudinal bottom horizontal tube with right-angle coupler. When the foundation of upright tube is not at the same height, the longitudinal bottom horizontal tube from the high must be extended two spans to the low section and fixed with upright tube, and the height difference should not be greater than 1 m.

10. The installation of coupler should meet the following regulations:

    1) The specification of coupler must be same with the outer diameter of steel tube;

    2) The tightening torque of bolt should not be smaller than 40N.M and not be greater than 65N.M;

    3) The mutual distance of central points for right-angle coupler used to fix longitudinal and transverse horizontal tubes, bridging and transverse diagonal brace, etc. at the main node should not be greater than 150 mm;

    4) The opening of butt coupler should be upward or inward;

11. The erection of rail and baffle for operation level and chute should meet the following regulations:

    1) The rail and baffle should be erected at the inner side of outer upright tube;

    2) The epithelial height of upper rail should be 1.2 m;

    3) The height of footplate should not be smaller than 180 mm;

    4) The middle rail should be set medially.

12. The laying of foot plank should meet the following regulations:

    1) The foot plank should be laid completely and set with 120-150 mm skirting line;

    2) The probe of foot plank should be fixed on the support bar with galvanized steel wire with the diameter of 3.2 mm;

    3) The foot plank at the corner and chute platform mouth should be connected reliably with the transverse horizontal tube to prevent slippage;

VI. Dismantling

1. The preparations before the dismantling of scaffold should meet the following regulations:

   1) Fully check whether the coupler connection, connecting tube and supporting system of scaffold

meet the structure requirements;

2) Supplement and improve the dismantling sequence and measures in the construction organization design according to the inspection result, and implement them only after the approval of competent department;

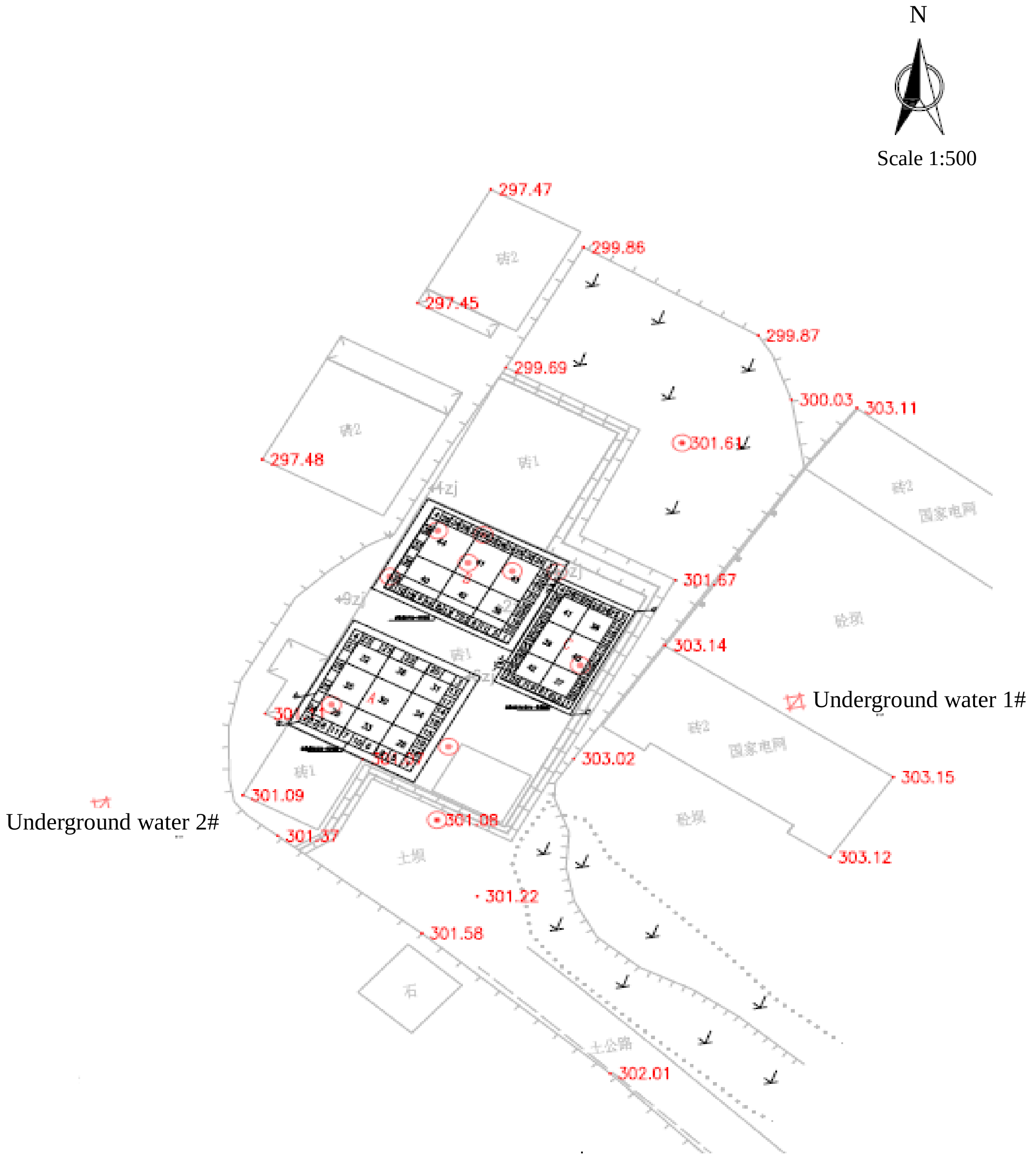
3) Remove sundries on scaffold and obstacles on the ground.

2. In case of dismantling scaffold, the following regulations should be met:

   1) The dismantling operation must be conducted from top to the bottom layer by layer, with the simultaneous operation of top and bottom parts not allowed;

   2) When the scaffold is dismantled to the height (about 6.5m) of last long upright tube at the lower part, first the temporary bracing should be erected at appropriate position for fixation, and then the connecting tube should be dismantled;

   3) When the scaffold is dismantled by section and facade, two ends of scaffold not to be dismantled should be first set with connecting tube and diagonal tube for fixation.



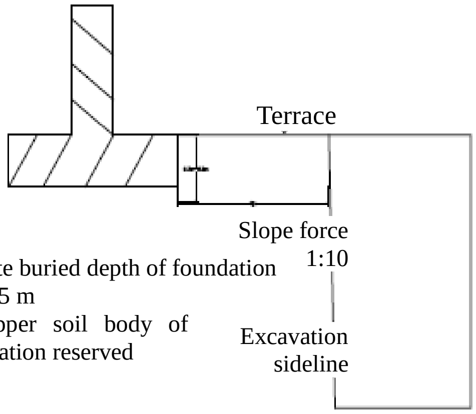
Legend

⊙ Supplementary sampling point

⌗ Underground water

✦ Supplementary sampling point

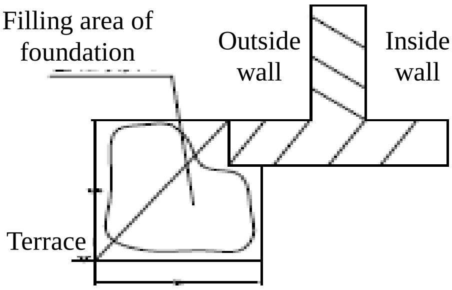
Design for Support of Dredging Construction of Ganshui Site



1. Note buried depth of foundation 0.3-0.5 m
2. Upper soil body of foundation reserved

Fig. S2-1

Work quantity Item	Plot C ditch c-d	Plot A a-b	Plot B
Mortar M10	20m^3		
	2m^3	10m^3	
Scaffold (m)	400	300	360
Bamboo springboard (m^2)	80	80	80



1. Foundation soil of the base loses, and Plot A (a-b) foundation has been monitored.
2. The base is filled with C20 concrete.

Fig. S2-2

Slag Removal Safeguards

(1) The investigated foundation is squared-stone shallow-buried one, and the basement is to the weathered mudstone and soil layer, of which the latter is at plastic state. The foundation of Plot A and B squared stones doesn’t deform, and that of Plot C has been eroded by water, resulting in local deformation of light body.

(2) The foundation soil body and base are not disturbed during the excavation, so it is determined that the soil body of bearing stratum at the bottom of foundation is protected (not disturbed), leaving reserved distance to determine the excavation line.

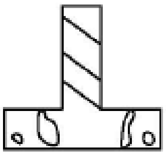
(3) Segmented netch-jumping excavation is conducted. After that, backfilling is carried out immediately, with the excavation of next section performed when the compaction degree is 90% through backfilling and compaction.

(4) The backfilled soil body should be transferred into the house by batches. After waste residues are excavated, they should be transported immediately and not be piled and filled within the house.

(5) Plot A (a-b) and Plot C (c-d) foundation has deformation signs, so its local structures should be remedied with C20 concrete, as shown in detail drawing 2-1.

(6) Upper structures (tile and beam) eroded by rainwater. During the excavation, wind and rain blows and beats tiles, and beams may cause harm to working personnel, so scaffold should be set indoors. On the top of scaffold, wooden or bamboo springboard should be laid.

(7) The top beam of Plot A, B and C can be installed with scaffold to support its beam. (Note: the wooden support of beam has been deformed)



1. The liquefaction phenomenon of base soil body is serious, so the existing off-the-wall groove is cleaned, and M10 mortar is used to plaster the surface and restore the groove.
2. The existing base damage is patched and restored with C20 concrete.

Fig. S2-3

Scaffold Construction Design Plan

CNSWGD

Southwest Geotechnical & Design Institute of China Nuclear Industry

July 21, 2014

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6	Steel tubes bent of horizontal tube and diagonal tube	L≤6.5m ≤30	

    ② It is prohibited to punch a hole on the steel tube.

2. Coupler:

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2) The couplers used for scaffold should not be damaged when the tightening torque of bolt reaches 6.5 N.M.

3. Foot plank

- Foot plank is square wood plank or bamboo plank, the mass of each plank should not be greater than 30 kg.
- The width is not smaller than 3 m, the length mustn't be greater than 6 m, and the mesh should not be larger than 10 cm. The vinylon, chinlon, nylon and other materials must be used. It is prohibited to use damaged or rotten safety net and polypropylene net. The dense mesh safety net can only be used as vertical net.

4. Precautions

1). The component and fittings passing the inspection should be classified according to the variety and specification, and piled tidily and steadily. There should be no ponding in the stocking area.

2). Sundries of erection site should be removed to level the erection site and keep the slagging smooth.

V. Erection (refer to attached checking calculation for data)

1. The scaffold must be erected according to the construction schedule. An erection height should not exceed two steps (50cm) above adjacent connecting tube.

2. After a scaffold is erected each time, the step distance, longitudinal distance, horizontal distance and the verticality of upright tube should be corrected.

3. The placement of base should meet the following regulations:

1) The base and pad should be accurately placed on the position line;

2) The pad should be wooden pad with the length no smaller than 2 spans and the thickness no smaller than 500 mm or box iron.

4. The erection of upright tube should meet the following regulations:

1) It is prohibited to use steel tubes with the outer diameter of 48 mm and 51 mm together;

2) Except the lap joint can be used on the top layer and step to connect the upright tubes, joints of other layers and steps must be connected with butt coupler; the butt coupler of adjacent upright tubes mustn't be within the same height and should meet the following regulations:

① Joints of two adjacent upright tubes should not be set within the same step, and the staggered distance in height of two adjacent joints of every upright tube within the same step is not smaller than 500 mm; the distance from each joint center to main contact should not be greater than 1/3 of step distance;

② The overlapping length should not be smaller than 1 m, and at least 2 rotary buckles should be used for fixation. The distance from the edge of end coupler coverplate to the tube end should not be smaller than 100 mm;

③ When the upright tube is started to be erected, a bracing should be set every 6 spans and can be dismantled only after the connecting tube is installed steadily.

5. The erection of longitudinal horizontal tube should meet the following regulations:

1) The longitudinal horizontal tube should be set at the inner side of upright tube, and its length should not be smaller than 3 spans;

2. The butt coupler should be used and the lap joint can also be adopted to connect the longitudinal horizontal tube.

6. The butt joint and lap joint should meet the following regulations:

1) The butt coupler of longitudinal horizontal tube should be in staggered arrangement, and the distance from each joint to the nearest main contact should not be greater than 1/3 of longitudinal distance.

2) The overlapping length should not be smaller than 1 m, and 3 rotary buckles should be set at equal interval for fixation. The distance from the edge of end coupler coverplate to the tube end should not be smaller than 100 mm.

3) The longitudinal horizontal tube should be taken as the support of transverse horizontal tube and fixed on the upright tube with right-angle coupler.

7. Within the same step of sealed scaffold, the longitudinal horizontal tube should be encircled and fixed with right-angle coupler and upright tube at internal and external angle.

8. The erection of transverse horizontal tube should meet the following regulations:

   1) The main contact must be set with a transverse horizontal tube and fastened with right-angle coupler, with dismantling prohibited. The center distance of two right-angle couplers at the main contact should not be greater than 150 mm.

   2) The transverse horizontal tube at non-main node on the operation level should be set according to the required equal interval to support foot plank, and the maximum interval should not be greater than 1/2 of longitudinal distance.

   3) The distance from one end against the wall of transverse horizontal tube of two-row scaffold to the decorative surface should not be greater than 100 mm.

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   The longitudinal bottom horizontal tube should be fixed on the upright tube at the place no greater than 200 mm from base epithelium with right-angle coupler. The transverse bottom horizontal tube should also be fixed on the upright tube adjoining the lower part of longitudinal bottom horizontal tube with right-angle coupler. When the foundation of upright tube is not at the same height, the longitudinal bottom horizontal tube from the high must be extended two spans to the low section and fixed with upright tube, and the height difference should not be greater than 1 m.

10. The installation of coupler should meet the following regulations:

    1) The specification of coupler must be same with the outer diameter of steel tube;

    2) The tightening torque of bolt should not be smaller than 40N.M and not be greater than 65N.M;

    3) The mutual distance of central points for right-angle coupler used to fix longitudinal and transverse horizontal tubes, bridging and transverse diagonal brace, etc. at the main node should not be greater than 150 mm;

    4) The opening of butt coupler should be upward or inward;

11. The erection of rail and baffle for operation level and chute should meet the following regulations:

    1) The rail and baffle should be erected at the inner side of outer upright tube;

    2) The epithelial height of upper rail should be 1.2 m;

    3) The height of footplate should not be smaller than 180 mm;

    4) The middle rail should be set medially.

12. The laying of foot plank should meet the following regulations:

    1) The foot plank should be laid completely and set with 120-150 mm skirting line;

    2) The probe of foot plank should be fixed on the support bar with galvanized steel wire with the diameter of 3.2 mm;

    3) The foot plank at the corner and chute platform mouth should be connected reliably with the transverse horizontal tube to prevent slippage;

VI. Dismantling

1. The preparations before the dismantling of scaffold should meet the following regulations:

   1) Fully check whether the coupler connection, connecting tube and supporting system of scaffold

meet the structure requirements;

2) Supplement and improve the dismantling sequence and measures in the construction organization design according to the inspection result, and implement them only after the approval of competent department;

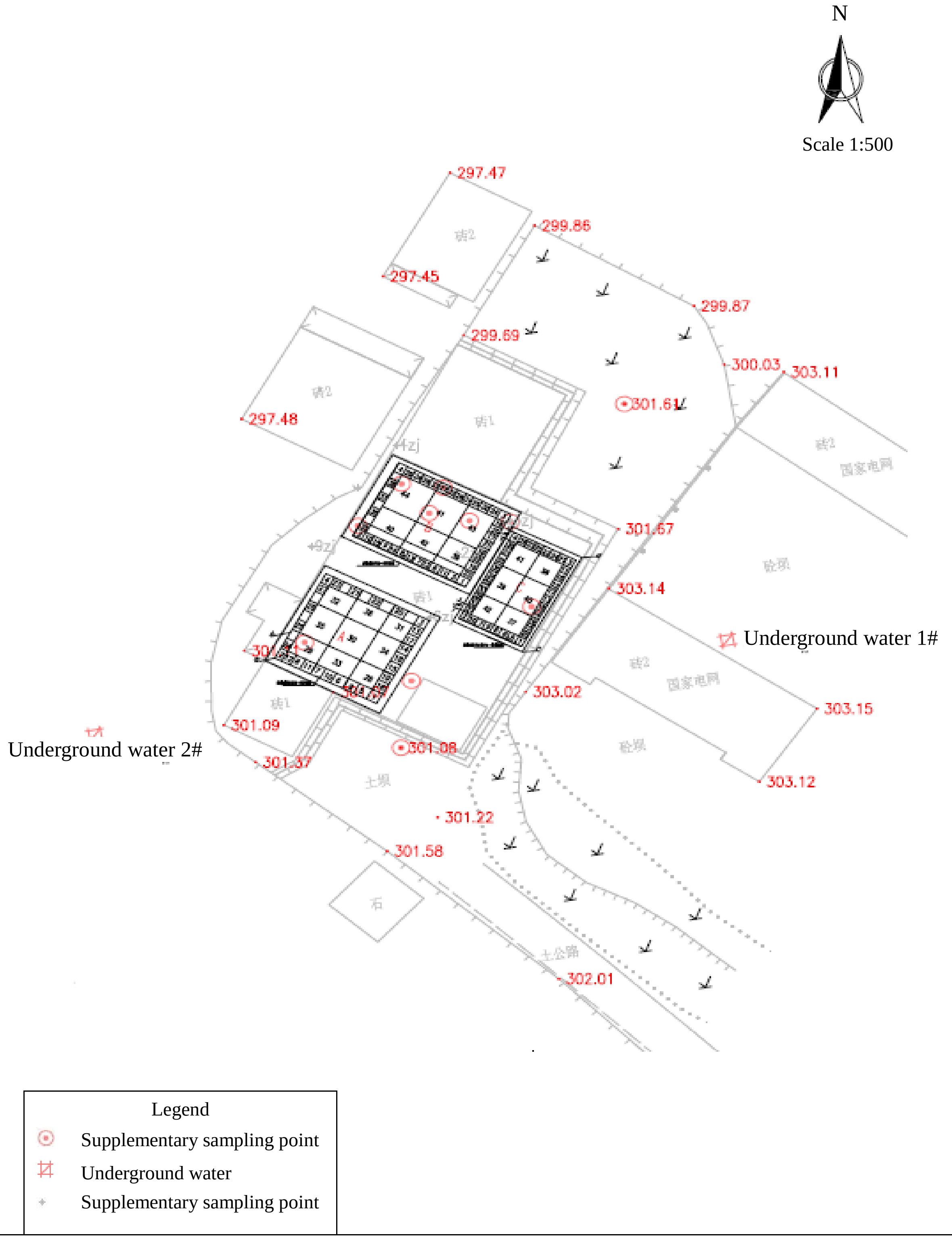
3) Remove sundries on scaffold and obstacles on the ground.

2. In case of dismantling scaffold, the following regulations should be met:

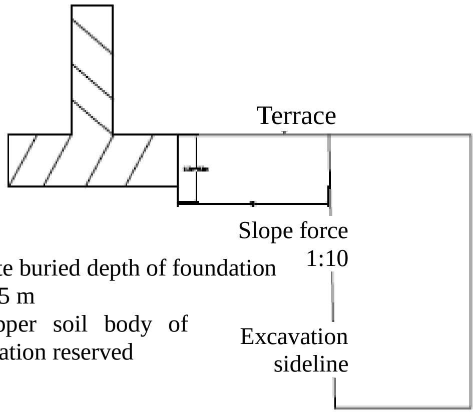
   1) The dismantling operation must be conducted from top to the bottom layer by layer, with the simultaneous operation of top and bottom parts not allowed;

   2) When the scaffold is dismantled to the height (about 6.5m) of last long upright tube at the lower part, first the temporary bracing should be erected at appropriate position for fixation, and then the connecting tube should be dismantled;

   3) When the scaffold is dismantled by section and facade, two ends of scaffold not to be dismantled should be first set with connecting tube and diagonal tube for fixation.

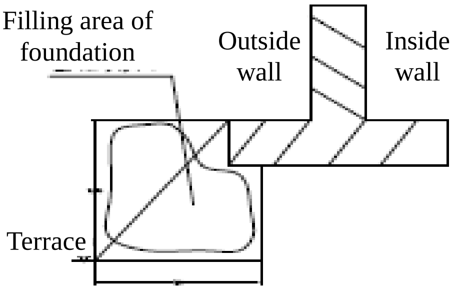


Design for Support of Dredging Construction of Ganshui Site



1. Note buried depth of foundation 0.3-0.5 m
2. Upper soil body of foundation reserved

Fig. S2-1



1. Foundation soil of the base loses, and Plot A (a-b) foundation has been monitored.
2. The base is filled with C20 concrete.

Fig. S2-2

Work quantity Item	Plot C ditch c-d	Plot A a-b	Plot B
Mortar M10	$20m^3$		
	$2m^3$	$10m^3$	
Scaffold (m)	400	300	360
Bamboo springboard (m^2)	80	80	80

Slag Removal Safeguards

(1) The investigated foundation is squared-stone shallow-buried one, and the basement is to the weathered mudstone and soil layer, of which the latter is at plastic state. The foundation of Plot A and B squared stones doesn't deform, and that of Plot C has been eroded by water, resulting in local deformation of light body.

(2) The foundation soil body and base are not disturbed during the excavation, so it is determined that the soil body of bearing stratum at the bottom of foundation is protected (not disturbed), leaving reserved distance to determine the excavation line.

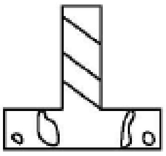
(3) Segmented netch-jumping excavation is conducted. After that, backfilling is carried out immediately, with the excavation of next section performed when the compaction degree is 90% through backfilling and compaction.

(4) The backfilled soil body should be transferred into the house by batches. After waste residues are excavated, they should be transported immediately and not be piled and filled within the house.

(5) Plot A (a-b) and Plot C (c-d) foundation has deformation signs, so its local structures should be remedied with C20 concrete, as shown in detail drawing 2-1.

(6) Upper structures (tile and beam) eroded by rainwater. During the excavation, wind and rain blows and beats tiles, and beams may cause harm to working personnel, so scaffold should be set indoors. On the top of scaffold, wooden or bamboo springboard should be laid.

(7) The top beam of Plot A, B and C can be installed with scaffold to support its beam. (Note: the wooden support of beam has been deformed)



1. The liquefaction phenomenon of base soil body is serious, so the existing off-the-wall groove is cleaned, and M10 mortar is used to plaster the surface and restore the groove.
2. The existing base damage is patched and restored with C20 concrete.

Fig. S2-3

重庆市建设项目环境保护设计备案审查意见书

渝（市）环设备〔2010〕067 号

重庆腾辉地维水泥有限公司：

你单位报送的水泥窑协同处置污染土壤生产线项目环境保护设计方案及有关图说收悉。根据专家审查意见，原则同意该项目环保设计方案，但应按专家组意见，将窑头三电场除尘设施改为双室四电场除尘设施。请你单位按照专家审查意见进一步优化设计方案，落实环保资金，及时组织实施，确保环保设施与项目主体工程同时投入使用。项目完工后，应于试生产前 15 日向我局提出试生产申请，未经我局批准，该项目不得擅自投入试生产。

附：环境保护设计专家评审意见

二〇一〇年八月十二日

抄　送：重庆市环境监察总队，江津区环保局

渝（市）环准〔2009〕224号

重庆腾辉地维水泥有限公司：

你单位报送的水泥窑协同处置污染土壤生产线项目环境影响报告书（以下简称“报告书”）和重庆市环境工程评估中心关于该项目的技术评估报告（渝环评估书〔2009〕368号）及相关材料收悉。经研究，现审批如下：

一、根据《中华人民共和国环境影响评价法》等法规，原则同意报告书的结论及其对该建设项目提出的环境保护措施，从环境保护的角度，批准该项目在江津区珞璜镇重庆腾辉地维水泥有限公司厂区内建设。

二、建设项目的主要建设内容为：新建污染土壤入窑系统和污染土壤的储存系统，日处理原重庆天原化工总厂址内受污染土壤70吨。项目总投资约971.3万元。

三、该项目应严格按照本批准书附件规定的排放标准及总量控制指标执行，不得突破。

四、该项目在建设和运营过程中，应认真落实环境影响报告书所提出的污染防治措施及生态保护措施，重点作好以下工作，以确保污染物达标排放和满足总量控制的要求，防止污染环境和环境风险事故发生：

（一）采取有效措施，提高清灰效果，确保水泥生产线各产尘点达到《水泥工业大气污染物排放标准》（GB4915-2004）表2标准，并控制二噁英的再生。

（二）30000m^3污染土壤贮存场应作防渗处理，设置顶棚和集排水设施，满足《一般工业固体废物贮存、处置场污染控制标准》（GB18599-2001）Ⅱ类场及《危险废物贮存污染控制标准》（GB18597-2001）要求。同时还需设置27.5m^3的调节池并作防渗处理，

用于收集污染土壤贮存场的渗滤液，渗滤液定期送悬窑窑尾焚烧。

（三）采取减振、隔声等降噪措施，确保厂界噪声达到《工业企业厂界环境噪声排放标准》（GB12348—2008）。

（四）该项目卫生防护距离为污染土壤贮存场外600米，该距离范围内不得规划建设居民集中住宅、医院、学校等环境敏感点。

（五）加强对二噁英的环境监测。在项目投产前需对二噁英背景值进行监测。

（六）加强对污染土壤运输环节的管理，制定环境风险防范措施，避免发生二次污染。

（七）项目实施完毕后，应及时对污染土壤贮存场进行生态恢复。

五、该项目开工前，应到我局办理环保设计方案备案手续。项目建设必须严格执行环境保护设施与主体工程同时设计、同时施工、同时投入使用的环境保护“三同时”制度。项目竣工投入试生产前，应向我局申请该建设项目环境保护试生产。

六、该项目的性质、规模、地点、采用的生产工艺或者防治污染、防止生态破坏的措施发生重大变动的，你单位应当重新报批建设项目的环境影响评价文件。

七、请江津区环保局负责对该项目环境保护的日常监督管理。

2009 年 8 月 27 日

抄送：重庆市环境监察总队，重庆市固体废物管理中心，江津区环保局，
中国医药集团重庆医药设计研究院。

附件：重庆腾辉地维水泥有限公司水泥窑协同处置污染土壤生产线项目污染物排放标准及总量指标

一、废气

污染源	排放标准及标准号	污染因子	有组织排放			无组织排放浓度(mg/m^3)	总量指标(kg/a)
			排放口高度（m）	浓度(mg/m^3)	速率限值（kg/h）		
窑尾废气	《水泥工业大气污染物排放标准》(GB4915-2004)	SO_2	95	200	/	/	/
		NO_2		800	/	/	/
		颗粒物		50	/	/	/
		HCl		60	/	/	/
		汞及其化合物		0.1	/	/	/
		砷、镍及其化合物		1.0	/	/	/
		铅及其化合物		1.0	/	/	/
		二噁英		0.1 ngTEQ/Nm^3	/	/	/
储存场	《大气污染物排放标准》（GB16297-1996）	颗粒物	/	/	/	1.0	/
		HCl		/	/	0.2	/
		非甲烷总烃		/	/	4.0	/

二、噪声

排放标准及标准号	最大允许排放值		备注
	昼间（db）	夜间（db）	
《工业企业厂界环境噪声排放标准》（GB12348-2008）3 类标准	65	55	施工噪声执行《建筑施工场界噪声限值》（GB12523-90）

2009 年 8 月 27 日

重庆市建设项目环影响评价要求通知书

渝（市）环评通〔2009〕135号

重庆腾辉地维水泥有限公司：

你单位报送的水泥窑协同处置污染土壤生产线项目环境保护申报表收悉。根据《重庆市环境保护条例》等相关环境保护法律法规的规定，就开展该项目环境影响评价工作通知如下：

一、按照环境保护部《建设项目环境影响评价分类管理名录》的要求，你单位应委托具有相应资质的环境影响评价单位编制该项目环境影响报告书。

二、该项目环境影响评价应按照项目所在地环境功能区对应的环境质量标准、污染物排放标准和区域环境容量进行。

三、项目如需新增主要污染物（SO_2、COD）排放总量的，应到项目所在地环保部门取得排放指标。

四、环境影响报告书表应按照国家建设项目环境影响评价技术导则的要求进行编制，对建设项目选址的合理性、建设项目所在地的环境敏感目标、环境影响以及拟采取污染防治措施进行充分论证和评价。

五、环境影响报告书报送我局审批前，应委托有资质的环境影响评估机构进行技术评估。项目环境影响报告书未经我局审批，项目不得擅自开工建设。

（盖章）

二00九年五月二十二日

抄送：江津区环境保护局。

重庆市建设项目竣工环境保护验收批复

渝（市）环验〔2011〕109号

重庆拉法基瑞安地维水泥有限公司：

你单位报送的水泥窑协同处置污染土壤生产线项目竣工环境保护验收申请和重庆市环境监测中心的竣工环保验收监测报告收悉。经研究，现批复如下：

该项目的环保设施、环境风险防范措施和各项污染物排放等有关环境保护工作基本达到我局的审批要求，原则同意该项目的竣工环境保护验收。你单位应严格执行环保管理制度，加强环保设施的维护和保养，确保设施正常运行和污染物稳定达标排放，杜绝污染事故和扰民事件的发生。加强环境风险应急演练，确保环境安全。

该装置不得接收、处理危险废物、工业固体废物。运行期间必须严格执行污染土壤转移联单制度。

请在接到本批复后十日内到江津区环保局办理正式排污许可证。由江津区环保局负责该项目日常监督管理。

附件：验收组意见

二〇一一年十一月一日

抄　送：重庆市环境监察总队，重庆市固体废物管理中心，
江津区环保局。

验收组意见：

2011 年 9 月 8 日，重庆市环境保护局组织江津区环境保护局及有关专家对重庆拉法基瑞安地维水泥有限公司水泥窑协同处置污染土壤生产线项目竣工环境保护验收（验收组名单附后），参加的单位有重庆市环保局、江津区环境保护局、重庆市环境监测中心、重庆拉法基瑞安地维水泥有限公司（原名为重庆腾辉地维水泥有限公司）。验收组通过踏勘现场，听取业主单位对该项目在建设中执行环境影响评价和“三同时”制度情况和重庆市环境监测中心对该项目竣工验收监测情况介绍，经认真讨论，形成如下竣工环境保护验收意见：

一、项目基本情况

重庆拉法基瑞安地维水泥有限公司位于重庆市江津区珞璜镇珞璜建材工业园区，其水泥窑协同处置污染土壤生产线项目是利用重庆腾辉地维水泥厂 2500t/d 干法窑在生产水泥过程，把受污染土壤作为一部分水泥替代原料，以一定比例从干法窑烟室处喂入窑的锻烧系统中，经过入窑高温锻烧，与其它水泥原料进行充分化学反应，将有害的成分去除，从而实现废物的有效处理和利用。

工程建设内容主要由两部分组成：依托已有的 2500t/d 新型干法熟料生产线，新建（1）存储量约 50000 吨的污染土壤储存系统，主要包括污染土壤贮存仓库、仓库周边排水系统、渗滤液收集系统等；（2）污染土壤入窑系统，主要包括污染土壤进料仓、计量称、提升机、除尘器等；（3）常规污染物处理系统，依托原有窑尾除尘系统净化处理，该公司对窑头三电场除尘设施进行了技术改造，更换了稳压设施，增加了烟气增湿喷雾降温装置。

该工程总处理污染土壤量为 30000 吨，日处理污染土壤约 70t。

项目总投资 780 万元。工程于 2009 年 12 月开工建设， 2010 年 11 月投入试生产。

二、环境管理

按照国家有关环境保护的法律法规，该项目进行了环境影响评价，履行了建设项目环境影响审批手续。工程相应的环境保护设施与主体工程同时设计、同步施工、同时投入使用，该项目基本执行了建设项目“三同时”管理制度。该公司设置了工艺环保部，负责公司日常的环境保护管理工作，设置有1名专职环保管理人员，建立了环境保护管理制度。

三、主要污染防治措施及环境保护措施

（一）废气治理措施

该项目废气来自土壤储库、入窑系统以及窑尾废气。

（1）土壤储库主要污染物为挥发性有机物，采取自然通风的方式。

（2）入窑系统主要污染物为挥发性有机物，对卸料点采取全密封和机械通风的方式。

（3）窑尾废气主要治理措施为：常规污染物依托原有窑尾除尘系统净化处理；对二

噁英的处置主要在温度和停留时间的控制，污染土壤投加于烟室，窑内停留时间约30min，物料最高温度可达1450℃，保证土壤中的微量固相二噁英完全裂解；燃烧废气经烟室、分解炉和预热器进入增湿塔，使气体温度从350℃迅速降至150℃以下，防止了二噁英的再生；废气经高效布袋除尘器截留附着在粉尘上的二噁英；而生料中的碱性氧化物在窑内高温下可与污染土壤中的氯元素结合，形成稳定的氯化物，抑制了氯源的产生，从而达到对二噁英的处置。

（二）废水治理措施

项目新增部分不增加用水量，厂区原有废水利用已有处理措施。地维公司主要排放的污废水为冷却循环排污水和工作人员产生的生活污水。冷却循环排污水均经生产废水处理装置隔油、沉淀等工艺处理后回用；生活污水设置有生活污水处理装置，采用生化处理工艺，出水达到《污水综合排放标准》（GB8978-1996）中一级标准排入长江。

（三）噪声

本项目噪声来自卸料区收尘器引风机。其影响削减措施为：将风机设为整体支架，并安装减震器减振以及利用建筑隔声等。

（四）固废

项目新增部分不增加固废排放量，厂区原有固废利用已有措施处理。即水泥生产过程中产生的烟（粉）尘通过袋式或电除尘器收集后，均返回生产系统使用，地维水泥公司排放的固体废弃物主要为污废水处理系统产生的污泥和厂区工作人员产生的生活垃圾，废水处理系统产生的污泥经过干化处理后，与生活垃圾一并送城市垃圾处理场处置。

（五）风险防范措施

公司制订了《重庆拉法基瑞安地维水泥有限公司水泥窑协同处置污染土壤项目突发环境事件应急预案》；贮存场顶棚下设置与大气相连的通风口；储库周边修建了排水沟；在储库底部建防渗混凝土，周边铺防渗膜，再铺土工布，土工布上面铺沙袋，堆棚底部中央设渗滤液渗漏排水沟；修建地了 37.8m3 的渗滤液收集池；建立了库内作业操作规程；库内直接作业人员配备有专业防护服及防毒面罩；设置了600米的卫生防护距离，防护距离范围内无人员居住。

四、验收监测情况

重庆市环境监测中心于 2011 年 7 月 14 日～7 月 15 日对该项目进行了环保验收监测，验收监测期间，该项目生产以及环保设施运行正常，生产负荷在 105.3%～105.6%之间，污染土壤处理负荷在 102.8%～108.6%之间，均在 80%以上，符合验收监测要求。

（一）废气有组织排放

验收监测期间，窑尾废气有组织排放的各污染物最大排放浓度为：颗粒物 36.7mg/m3、二氧化硫 78mg/m3、氮氧化物 1.23×102mg/m3、氯化氢 0.584mg/m3、二噁英 0.016ngTEQ/Nm3，均满足《水泥工业大气污染物排放标准》（GB4915-2004）“新建生产线”

的标准限值要求。窑尾布袋除尘器的平均除尘效率为99.9%。

砷、镍及其化合物（以As+Ni计）最大排放浓度为2.06×10-2mg/m3、铬、锡、锑、铜、锰及其化合物（以Cr＋Sn＋Sb＋Cu＋Mn计）最大排放浓度为5.84×10-2mg/m3、汞及其化合物、铅及其化合物、镉及其化合物均为未检出，均满足《重庆市建设项目环境影响评价文件批准书》渝（市）环准[2009]224号文附件中排放限值和《危险废物焚烧污染控制标准》（GB18484-2001）的排放限值要求。

窑头废气有组织排放的各污染物最大排放浓度分别为：颗粒物28.4mg/m3、二氧化硫48.6mg/m3。均满足《水泥工业大气污染物排放标准》（GB4915-2004）“新建生产线”的标准限值要求。窑头除尘器的平均除尘效率为99.8%。

（二）废气无组织排放

验收监测期间，废气无组织排放的各污染物最大浓度分别为：颗粒物0.183mg/m3、非甲烷总烃0.663mg/m3、HCl4.72×10-2 mg/m3，均满足《大气污染物综合排放标准》（GB16297-1996）表2中无组织排放标准限值要求。

（三）项目处置污染土壤

验收监测期间，抽测入窑的污染土壤中各污染物浓度分别为：汞0.024mg/kg、镉0.290mg/kg、砷11.3mg/kg、铅116mg/kg、镍136mg/kg、铬110mg/kg、锡2.99mg/kg、锑4.49mg/kg、铜29.6mg/kg、锰1040mg/kg、苯并芘3.60×10-3mg/kg、二噁英1257.23ngTEQ/kg。本次抽测结果中的砷、镍、铬、铜、锰含量高于环评提供的结果值，汞、铅、锡含量低于环评提供的结果值。

（四）排放总量

经核算，该项目窑尾污染物排放总量分别为：烟尘71.2t/a、SO2156.2t/a，均未超过重庆市排放污染物许可证渝（津）环排证（气）[2010]039-8号中的总量指标要求，窑头烟尘排放总量为45.4 t/a，未超过重庆市排放污染物许可证渝（津）环排证（气）[2010]039-9号中的总量指标要求。

五、验收组现场检查结论

综上所述，该项目环境管理资料、档案齐备，企业建立了环境管理制度。项目配套的环保措施及设施基本按照环评及批复的要求落实，项目基本满足验收要求。原则同意通过验收。

六、建议和要求

（一）该项目装置作为本批次污染土壤治理修复的终端设施，在运行中应严格执行国家环境保护标准和要求，不得接收、处理危险废物、工业固体废物和高风险、高浓度的污

染土壤。

（二）严格执行环境保护制度及相关规定。污染土壤接收、暂存、厂内运输、处理处置执行污染土壤转移联单制度，未经批准，不得接收；收集、暂存、厂内运输、处置污染土壤必须采取防扬散、防流失、防渗漏或者其它防止污染环境的措施；污染土壤处置全过程执行台账管理制度，污染土壤种类、污染因子、浓度或风险值（污染程度）、数量等纳入台账管理；

（三）加强对各类环保设施的日常管理维护和对企业员工的操作培训，保证环保设施的正常运行，避免污染物的事故性排放，确保各项污染物长期稳定达标排放。

（四）加强污染土壤处置期间的环境风险应急管理，制定意外事故的防范措施和应急预案，并向所在地环保部门备案.如出现环境异常情况应及时报告环境保护主管部门，并采取有效应对措施，确保人员及环境安全。

Ownership complement

The Ganshui Supply and Marketing Cooperative, Qijiang have a complete property rights and use rights for the Tieshiya Nongzi (agricultural fertilizer and pesticide) Warehouse and the staff quarter in front of this warehouse. The couple now living in the staff quarter is temporary on-duty personnel arranged by our cooperative and has no ownership and use right for this house.

One month prior to the warehouse remediation (site clearance), our cooperative notified it to the temporary on-duty couple who now lives in front of warehouse, and told them to relocate and give necessary assistance for relocation.

The statement is hereby made!

Ganshui Supply and Marketing Cooperative, Qijiang

July 25, 2014

Seal: Ganshui Supply and Marketing Cooperative, Qijiang

Ownership complement

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Ganshui Supply and Marketing Cooperative, Qijiang

July 25, 2014

Seal: Ganshui Supply and Marketing Cooperative, Qijiang

Public Questionnaire

Project name	Environmental Risk Assessment of Typical Storing Site for Pesticide POPs in Qijiang District, Chongqing		
Investigation site	Nongzi Warehouse of Ganshui Supply and Marketing Cooperative		
Name		Investigation time	
Gender	Male Female	Investigator	
Age	Age under 30 years old 30-40 40-50 50-60 Age above 60 years old		
Place of residence	Residential area for staff Nearby residents Working nearby Working in the warehouse Others		

1. You know what once stored in the original warehouse of investigation site? If you know the type and quantity of pesticide stored, please specify.

2. You think whether the original warehouse within the investigation site will cause pollution to the environment? (Please tick "√" at the back of answer you selected)

Yes No Unclear

3. You think what are main adverse impact of original warehouse on the surrounding environment? (Please tick "√" at the back of answer you selected)

Ambient air Rivers forming into groundwater Soil Noise No effect Unclear

4. You know whether environmental dispute or environmental pollution event happens within the investigation site? If any, please specify.

(Please tick "√" at the back of answer you selected)

Yes No

Detail description:

5. You think whether the site and its surrounding area are suitable for living? (Please tick "√" at the back of answer you selected)

Very suitable Suitable Basically suitable Not suitable Not very suitable

6. What are your views for relocation activity of this warehouse? (Please tick "√" at the back of answer you selected)

Agree Disagree Uncertain temporarily

7. Other opinions and suggestions:

Public Questionnaire

Project name	Environmental Risk Assessment of Typical Storing Site for Pesticide POPs in Qijiang District, Chongqing		
Investigation site	Nongzi Warehouse of Ganshui Supply and Marketing Cooperative		
Name		Investigation time	
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(Please tick "√" at the back of answer you selected)

Yes No

Detail description:

5. You think whether the site and its surrounding area are suitable for living? (Please tick "√" at the back of answer you selected)

Very suitable Suitable Basically suitable Not suitable Not very suitable

6. What are your views for relocation activity of this warehouse? (Please tick "√" at the back of answer you selected)

Agree Disagree Uncertain temporarily

7. Other opinions and suggestions:

Public Questionnaire

Gender of investigator		Age	
Living distance from investigation target	<200m	200-500m	>500m
Familiarity with investigation target	Unfamiliar	Generally familiar	Particularly familiar
Whether you understand the previous use of the site	Understand	Not understand	
Do you understand POPs	Never heard	Not understand	Heard, but not understand
Whether you know the OCPs belongs to POPs	Know	Unknown	
You think whether the target site is dangerous	Yes	No	Not understand
Cancer incidence of surrounding residents	High	Low	Not understand
You think what is the pathway of hazard diffusion? Air	Rainwater	Soil	Others
Whether you smell the odor of pesticide	Yes	No	
Whether the underground water is used	Yes	No	
Whether you understand the demolition decision of the government to the site	Yes	No	
Whether you agree with the relocation	Yes	No	

Investigation time: _______, 2014

Public Questionnaire

Gender of investigator		Age	
Living distance from investigation target	<200m	200-500m	>500m
Familiarity with investigation target	Unfamiliar	Generally familiar	Particularly familiar
Whether you understand the previous use of the site	Understand	Not understand	
Do you understand POPs	Never heard	Not understand	Heard, but not understand
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You think what is the pathway of hazard diffusion? Air	Rainwater	Soil	Others
Whether you smell the odor of pesticide	Yes	No	
Whether the underground water is used	Yes	No	
Whether you understand the demolition decision of the government to the site	Yes	No	
Whether you agree with the relocation	Yes	No	

Investigation time: _______, 2014

Public Participation Questionnaire for Site Project of Nongzi Warehouse in Ganshui

I. Basic Information	
Name:	Gender:
Age:	Occupation:
Degree of education:	Tel.:
Unit or domicile:	
II. Project Overview	

In local areas (about 50m^2) of Nongzi Warehouse, Ganshui, Qijiang District, the soil and plastering (about 220m^3) need to be disposed due to the storage of pesticide. With the help of the World Bank's Global Environment Facility (GEF), the soil and plastering within the warehouse need to be cleared, sealed and transported to the Jiangjin Lafarge Cement Plant for temporary storage. The construction time of the project is about 10 days. All constructions are conducted indoors and its main environmental impact is noise, so the construction is not allowed to be conducted at night and during lunch break in the process of project implementation. Qijiang Environmental Protection Bureau will supervise the project implementation. In case of any complaint, please dial 023-12369.

III. Investigation Contents				
1. Living distance from target	<200m☐	200-500m ☐		>500m ☐
2. You think what is the transmission route of site pollution hazard?	Air☐	Rainwater☐	Soil☐	Others☐
3. Whether you smell the odor of pesticide in the warehouse?	Yes☐	No☐		Unclear☐
4. Whether you hope the pollution of this site is restored as soon as possible?	ASAP			Doesn't matter☐
5. You think what is the biggest impact of the implementation of pollution remediation project of the site on the environment and surrounding residents?	Waste gas☐	Waste water☐	Dust☐	Noise☐
	Transportation☐	Safety☐	Solid waste☐	Ecology☐
	Health☐	Others☐		
6. What influence may bring to you during the project implementation?	Affect the house safety☐	Affect the access road☐		Affect the garden plants, etc.☐
7. Whether you accept the influence?	Acceptable☐	Doesn't matter☐		Unacceptable☐ Causes:

8. Whether you understand and accept the environmental protection measures adopted during the project implementation?	Acceptable☐	Doesn’t matter☐	Unacceptable☐ Causes:
9. Whether you agree with the implementation of this project under the premise of adopting environmental protection measures?	Yes☐	No☐	Doesn’t matter☐
10. Overall opinions and suggestions to the implementation of this project:			

Public Participation Questionnaire for Site Project of Nongzi Warehouse in Ganshui

I. Basic Information	
Name:	Gender:
Age:	Occupation:
Degree of education:	Tel.:
Unit or domicile:	
II. Project Overview	
In local areas (about 50m^2) of Nongzi Warehouse, Ganshui, Qijiang District, the soil and plastering (about 220m^3) need to be disposed due to the storage of pesticide. With the help of the World Bank's Global Environment Facility (GEF), the soil and plastering within the warehouse need to be cleared, sealed and transported to the Jiangjin Lafarge Cement Plant for temporary storage. The construction time of the project is about 10 days. All constructions are conducted indoors and its main environmental impact is noise, so the construction is not allowed to be conducted at night and during lunch break in the process of project implementation. Qijiang Environmental Protection Bureau will supervise the project implementation. In case of any complaint, please dial 023-12369.	
III. Investigation Contents	

1. Living distance from target	<200m☐	200-500m ☐		>500m ☐
2. You think what is the transmission route of site pollution hazard?	Air☐	Rainwater☐	Soil☐	Others☐
3. Whether you smell the odor of pesticide in the warehouse?	Yes☐	No☐		Unclear☐
4. Whether you hope the pollution of this site is restored as soon as possible?	ASAP			Doesn't matter☐
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	Transportation☐	Safety☐	Solid waste☐	Ecology☐
	Health☐	Others☐		
6. What influence may bring to you during the project implementation?	Affect the house safety☐	Affect the access road☐		Affect the garden plants, etc.☐
7. Whether you accept the influence?	Acceptable☐	Doesn't matter☐		Unacceptable☐ Causes:

8. Whether you understand and accept the environmental protection measures adopted during the project implementation?	Acceptable☐	Doesn’t matter☐	Unacceptable☐ Causes:
9. Whether you agree with the implementation of this project under the premise of adopting environmental protection measures?	Yes☐	No☐	Doesn’t matter☐
10. Overall opinions and suggestions to the implementation of this project:			

Screening Table of Environmental and Social Safety Guarantee of Demonstration Site

Table 1 Basic Information

Site Name:	Ganshui Supply and Marketing Warehouse, Qijiang District, Chongqing Municipality	Location	Ganshui Town, Qijiang District, Chongqing Municipality
Project proponent:		Contact person:	Chongqing Solid Waste Management Center
Type of land use:	Warehouse of pesticides producing POPs	Land owner:	Qijiang Ganshui Supply and Marketing Cooperative
Brief description about the Site (including potential pollution and other buildings or attachments, residents and the like within the construction scope of clearing pollutants on ground): Founded in 1961, Ganshui Supply and Marketing Warehouse occupies an area of about 667m^2 and is located in Ganshui Town, Qijiang District, Chongqing Municipality. It is used for storing pesticides such as BHC, DDT, folimat, 2,2-dimethyl dichlorovinyl phosphate and its soil and constructions may have pollutants including organochlorine, organophosphorus, lead, mercury, arsenic, etc. Through sampling and survey, it is found out that the total content of BHC and arsenic exceeds the screening value of contaminated site of Beijing (HJ 350-2007) and the soil intervention value (RSL 2013) issued by US EPA, so contaminated soil of the Site needs to be restored.			
Summary of screening result: The Site belongs to Type A sites (OP 4.01) since it contains priority pollutants and is close to the river and site clearing easily negatively impacts the surrounding environment. The pollution of the Site is within the actual area of constructions and facilities (warehouses). Site clearing will not cause the significant change or degradation of any natural habitat or have negative influence on physical cultural resources, require the construction of a new flood control dam or rely on any existing flood control dam or any dam under construction since the Site is 20 m away from the river and there is river revetment between the Site and the river; the Site is close to a family which should be relocated during site clearing and restoration and a temporary settlement compensation plan should be implemented, so there is no involuntary immigration of any individual or family; during site restoration, nobody is prohibited from using economic resources which they use daily; no temporary or permanent damage is caused to any crop, fruit three or household facility; and the Site is not located in the living area of any minority, so no minority is involved.			

Table 2 Screening List Specified by China

Whether the project needs any of the following safety guarantee documents?	**Yes**	**No**	**Please specify other documents if needed**
Complete environmental impact assessment			
Simplified environmental impact assessment (assessment form)	√		
Other document requirements			

Table 3 Screening List of Environmental and Social Safety Guarantee of the World Bank

Screening item		Yes	No	Un known	Description	Policy of the World Bank adopted if the answer is yes	Document requirements (If the answer is “yes”)
I	**ENVIRONMENTAL AND SOCIAL IMPACT**						
1	Whether the impacts of a subproject are various or unprecedented significant adverse environment impacts which must be carefully handled? [1] (Note: significant adverse environment impacts refer to impacts meeting any of the following condition.)	√			The Site contains priority pollutants and is close to the river and site clearing may have negative impacts on the surrounding environment.	OP 4.01 Environmental Assessment Type A	Polluted site-specific environmental assessment (including environmental management plan)
	-- The subproject is located in or near an environment-sensitive area (such as forest, grassland, river and wet land), social reserve (such as national park, natural reserve and world heritage site) or biosphere reserve.	√			The Site is located in a remote area of Ganshui Town, it is Ganshui River 300m away from the back of the Site and there is no forest, grassland, wet land, national park, natural reserve, world heritage site) or biosphere reserve and the like (see 4.11.3).		
	-- The subproject contains priority pollutants.	√			Potential pollutants include mercury, arsenic and HCH, which exceed Grade A standard in Standard of Soil Quality Assessment for Exhibition Sites (interim) (see 4.11.11).		

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[1] Example of subproject which has various or unprecedented significant adverse environment impacts which must be carefully handled: large-scale earth excavation is conducted on a large and seriously contaminated site; the site is environment-sensitive or society-sensitive, restoration possibly brings potential significant environmental risks or large-scale immigration is expected.

Screening item	**Yes**	**No**	**Un known**	**Description**	**Policy of the World Bank adopted if the answer is yes**	**Document requirements (If the answer is "yes")**
-- The subproject causes the soil erosion and degradation of this area.		√		Site clearing will not cause soil erosion and degradation.		
-- A lot of excavated soil, wastes and other building debris directly discharged, improperly stored and produced during treatment by the subproject have negative impacts local soil, rivers, streams or underground water.	√			Possible evacuation, storage and transport of contaminated soil during site clearing may have negative impacts on the surrounding environment if not handled properly. Through taking temporary storage yard anti-rainwater and collection and treatment measures, negative impacts on the surrounding environment will be controlled.		
-- Wastes produced by the subproject are transported to other countries, which violates the Convention on Transboundary Movements of Hazardous Materials and Wastes.		√		Contaminated soil from site clearing is not transported overseas.		

Screening item		Yes	No	Un known	Description	Policy of the World Bank adopted if the answer is yes	Document requirements (If the answer is "yes")
2	Whether the pollution scope of the subproject has been wider than the actual area of places or constructions and facilities and irreversible significant adverse environmental impact has been caused?	√			The Site is mainly used to store pesticides, pollutants are mainly found in warehouses, the pollution scope of the pollutants does not exceed the actual area of constructions and facilities and no significant adverse environmental impact is caused (see 4.11.2 and 4.11.11).	OP 4.01 Environmental Assessment Type A	Polluted site-specific environmental assessment (including environmental management plan)
3	Whether the impacts of the subproject are less than those of Type A projects?		√		POPs of this type of contaminated sites are characterized by persistence, high toxicity and bioaccumulation and have significant and irreversible impacts on human health and environment.	OP 4.01 Environmental Assessment Type B	
4	Whether those impacts are caused by specific type of contaminated sites and minority impacts are irreversible?		√		China has many POPs contaminated sites of which almost all pollutants have had irreversible impacts.	OP 4.01 Environmental Assessment Type B	

Screening item		Yes	No	Un known	Description	Policy of the World Bank adopted if the answer is yes	Document requirements (If the answer is "yes")
5	Whether the proposed subproject hardly has or has no adverse environmental impact? [2]		√		The Site can have significant and irreversible impacts on the environment.	OP 4.01 Environmental Assessment Type C	
II	**NATURAL HABITATS**						
6	Whether the subproject causes the significant change or degradation of any natural habitat? [3]		√		The Site is not located in or near any natural habitat (see 4. 11.1 and 4.11.3).	OP 4.04 Natural habitats	
III	**PHYSICAL CULTURAL RESOURCES**						
7	Whether the subproject has negative impacts on any physical cultural resource? [4]		√		There is no historic urban area, religious monument, building and/or graveyard or archaeological or historical site such as relic specially recognized by the government in the Site.	OP 4.11 Physical Cultural Resources	The environmental management plan should contain "management procedures for physical cultural resources accidentally discovered".
IV	**DAM SAFETY**						

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[2] Subprojects hardly having or having no adverse environmental impact include the provision of goods or services and technical assistance and simple maintenance of damaged structures.

[3] The World Bank will not support any project which may result in the significant change or degradation of any natural habitat, especially important natural habitats (including natural habitats protected by laws, officially proposed to be protected, considered to have high protection value through the identification of authorities or protected by local traditional communities) unless such project has not feasible alternative solution and location and the comprehensive analysis of such project shows that the benefit of the project will be far more than the environmental cost. In this case, mitigation measures acceptable to the World Bank should be put forward, such as minimizing the loss of the natural habitat, building and maintaining an ecologically similar reserve, etc.

[4] Most physical cultural resources are archaeological or historical sites, including historic urban area, religious monument, building and/or graveyard or relics specially recognized by the government.

Screening item		Yes	No	Un known	Description	Policy of the World Bank adopted if the answer is yes	Document requirements (If the answer is "yes")
8	Whether the subproject requires the construction of a new flood control dam or relies on the existing dam or the dam under construction?		√		Ganshui River is about 300m away from north gate of the Site, but the river is provided with river revetment and the pollution area of the Site is small and not in the flood control area, so it is unnecessary to construct a new flood control dam. However, rainwater collection and cut-off measures should be taken during site clearing in order to prevent the dispersion of pollutants.	OP 4.37 Dam Safety	
V	**IMMIGRATION AND LAND ACQUISITION**						
9	Whether the project needs to acquire land (public or private, temporary or permanent) due to development need?		√		The Site is clearly owned by Ganshui Supply and Marketing Cooperative and is not leased currently and the clearing and evacuation area of the Site is small, so land acquisition is not required.	OP 4.12 Involuntary Immigration	
10	Whether anyone is prohibited from using any economic resource (such as pasture, fishing place and forest) which they use daily?		√		There is no economic resource within the Site.	OP 4.12 Involuntary Immigration	

Screening item		**Yes**	**No**	**Un known**	**Description**	**Policy of the World Bank adopted if the answer is yes**	**Document requirements (If the answer is "yes")**
11	Whether the project forces any individual or family to immigrate?		√		A family lives around the Site, a temporary settlement plan is implemented after the project organization and the management unit reach an agreement with the family, so there is no involuntary immigration of any individual or family.	OP 4.12 Involuntary Immigration	
12	Whether the project causes any temporary or permanent damage to any crop, fruit tree and household facility (such as barn, external toilet and kitchen)?		√		There is no crop, fruit tree and the like in the Site, but the walls of the house of a family living around the Site may be destroyed and shared walls will be reinforced during the implementation of the temporary settlement plan.	OP 4.12 Involuntary Immigration	
VI	**Minorities**						
13	Whether the project possibly has any adverse impact on tribal communities or vulnerable groups living in this area?		√		Residents around the Site belong to Han nationality and no minority lives here.	OP 4.10 Minorities	
14	Whether the group members living in this area benefit from the Project?		√		The Site is not the living area of minorities, so there is no minority benefiting from the Project.	OP 4.10 Minorities	

Screening item		Yes	No	Un known	Description	Policy of the World Bank adopted if the answer is yes	Document requirements (If the answer is "yes")
15	Whether any minority community is located within the Site and may be affected by the subproject?		√		The Site is not the living area of minorities, so no minority will be affected by site clearing.	OP 4.10 Minorities	

Table 4 Screening Result of Safety Guarantee Documents

Classification	**A**
Safety guarantee documents needing to be prepared:	Polluted site-specific environmental assessment (including environmental management plan)

Screened by: Wang Shijie ; Screening date: 2014-6-17

Screening Table of Environmental and Social Safety Guarantee of Demonstration Site

Table 1 Basic Information

Site Name:	Ganshui Supply and Marketing Warehouse, Qijiang District, Chongqing Municipality	Location	Ganshui Town, Qijiang District, Chongqing Municipality
Project proponent:		Contact person:	Chongqing Solid Waste Management Center
Type of land use:	Warehouse of pesticides producing POPs	Land owner:	Qijiang Ganshui Supply and Marketing Cooperative
Brief description about the Site (including potential pollution and other buildings or attachments, residents and the like within the construction scope of clearing pollutants on ground): Founded in 1961, Ganshui Supply and Marketing Warehouse occupies an area of about 667m^2 and is located in Ganshui Town, Qijiang District, Chongqing Municipality. It is used for storing pesticides such as BHC, DDT, folimat, 2,2-dimethyl dichlorovinyl phosphate and its soil and constructions may have pollutants including organochlorine, organophosphorus, lead, mercury, arsenic, etc. Through sampling and survey, it is found out that the total content of BHC and arsenic exceeds the screening value of contaminated site of Beijing (HJ 350-2007) and the soil intervention value (RSL 2013) issued by US EPA, so contaminated soil of the Site needs to be restored.			
Summary of screening result: The Site belongs to Type A sites (OP 4.01) since it contains priority pollutants and is close to the river and site clearing easily negatively impacts the surrounding environment. The pollution of the Site is within the actual area of constructions and facilities (warehouses). Site clearing will not cause the significant change or degradation of any natural habitat or have negative influence on physical cultural resources, require the construction of a new flood control dam or rely on any existing flood control dam or any dam under construction since the Site is 20 m away from the river and there is river revetment between the Site and the river; the Site is close to a family which should be relocated during site clearing and restoration and a temporary settlement compensation plan should be implemented, so there is no involuntary immigration of any individual or family; during site restoration, nobody is prohibited from using economic resources which they use daily; no temporary or permanent damage is caused to any crop, fruit three or household facility; and the Site is not located in the living area of any minority, so no minority is involved.			

Table 2 Screening List Specified by China

Whether the project needs any of the following safety guarantee documents?	**Yes**	**No**	**Please specify other documents if needed**
Complete environmental impact assessment			
Simplified environmental impact assessment (assessment form)	√		
Other document requirements			

Table 3 Screening List of Environmental and Social Safety Guarantee of the World Bank

Screening item		Yes	No	Un known	Description	Policy of the World Bank adopted if the answer is yes	Document requirements (If the answer is “yes”)
I	**ENVIRONMENTAL AND SOCIAL IMPACT**						
1	Whether the impacts of a subproject are various or unprecedented significant adverse environment impacts which must be carefully handled? [1] (Note: significant adverse environment impacts refer to impacts meeting any of the following condition.)	√			The Site contains priority pollutants and is close to the river and site clearing may have negative impacts on the surrounding environment.	OP 4.01 Environmental Assessment Type A	Polluted site-specific environmental assessment (including environmental management plan)
	-- The subproject is located in or near an environment-sensitive area (such as forest, grassland, river and wet land), social reserve (such as national park, natural reserve and world heritage site) or biosphere reserve.	√			The Site is located in a remote area of Ganshui Town, it is Ganshui River 300m away from the back of the Site and there is no forest, grassland, wet land, national park, natural reserve, world heritage site) or biosphere reserve and the like (see 4.11.3).		
	-- The subproject contains priority pollutants.	√			Potential pollutants include mercury, arsenic and HCH, which exceed Grade A standard in Standard of Soil Quality Assessment for Exhibition Sites (interim) (see 4.11.11).		

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[1] Example of subproject which has various or unprecedented significant adverse environment impacts which must be carefully handled: large-scale earth excavation is conducted on a large and seriously contaminated site; the site is environment-sensitive or society-sensitive, restoration possibly brings potential significant environmental risks or large-scale immigration is expected.

Screening item		Yes	No	Un known	Description	Policy of the World Bank adopted if the answer is yes	Document requirements (If the answer is "yes")
	-- The subproject causes the soil erosion and degradation of this area.		√		Site clearing will not cause soil erosion and degradation.		
	-- A lot of excavated soil, wastes and other building debris directly discharged, improperly stored and produced during treatment by the subproject have negative impacts local soil, rivers, streams or underground water.	√			Possible evacuation, storage and transport of contaminated soil during site clearing may have negative impacts on the surrounding environment if not handled properly. Through taking temporary storage yard anti-rainwater and collection and treatment measures, negative impacts on the surrounding environment will be controlled.		
	-- Wastes produced by the subproject are transported to other countries, which violates the Convention on Transboundary Movements of Hazardous Materials and Wastes.		√		Contaminated soil from site clearing is not transported overseas.		

Screening item		Yes	No	Un known	Description	Policy of the World Bank adopted if the answer is yes	Document requirements (If the answer is "yes")
2	Whether the pollution scope of the subproject has been wider than the actual area of places or constructions and facilities and irreversible significant adverse environmental impact has been caused?	√			The Site is mainly used to store pesticides, pollutants are mainly found in warehouses, the pollution scope of the pollutants does not exceed the actual area of constructions and facilities and no significant adverse environmental impact is caused (see 4.11.2 and 4.11.11).	OP 4.01 Environmental Assessment Type A	Polluted site-specific environmental assessment (including environmental management plan)
3	Whether the impacts of the subproject are less than those of Type A projects?		√		POPs of this type of contaminated sites are characterized by persistence, high toxicity and bioaccumulation and have significant and irreversible impacts on human health and environment.	OP 4.01 Environmental Assessment Type B	
4	Whether those impacts are caused by specific type of contaminated sites and minority impacts are irreversible?		√		China has many POPs contaminated sites of which almost all pollutants have had irreversible impacts.	OP 4.01 Environmental Assessment Type B	

Screening item		Yes	No	Un known	Description	Policy of the World Bank adopted if the answer is yes	Document requirements (If the answer is "yes")
5	Whether the proposed subproject hardly has or has no adverse environmental impact? [2]		√		The Site can have significant and irreversible impacts on the environment.	OP 4.01 Environmental Assessment Type C	
II	**NATURAL HABITATS**						
6	Whether the subproject causes the significant change or degradation of any natural habitat? [3]		√		The Site is not located in or near any natural habitat (see 4. 11.1 and 4.11.3).	OP 4.04 Natural habitats	
III	**PHYSICAL CULTURAL RESOURCES**						
7	Whether the subproject has negative impacts on any physical cultural resource? [4]		√		There is no historic urban area, religious monument, building and/or graveyard or archaeological or historical site such as relic specially recognized by the government in the Site.	OP 4.11 Physical Cultural Resources	The environmental management plan should contain "management procedures for physical cultural resources accidentally discovered".
IV	**DAM SAFETY**						

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[2] Subprojects hardly having or having no adverse environmental impact include the provision of goods or services and technical assistance and simple maintenance of damaged structures.

[3] The World Bank will not support any project which may result in the significant change or degradation of any natural habitat, especially important natural habitats (including natural habitats protected by laws, officially proposed to be protected, considered to have high protection value through the identification of authorities or protected by local traditional communities) unless such project has not feasible alternative solution and location and the comprehensive analysis of such project shows that the benefit of the project will be far more than the environmental cost. In this case, mitigation measures acceptable to the World Bank should be put forward, such as minimizing the loss of the natural habitat, building and maintaining an ecologically similar reserve, etc.

[4] Most physical cultural resources are archaeological or historical sites, including historic urban area, religious monument, building and/or graveyard or relics specially recognized by the government.

Screening item		Yes	No	Un known	Description	Policy of the World Bank adopted if the answer is yes	Document requirements (If the answer is “yes”)
8	Whether the subproject requires the construction of a new flood control dam or relies on the existing dam or the dam under construction?		√		Ganshui River is about 300m away from north gate of the Site, but the river is provided with river revetment and the pollution area of the Site is small and not in the flood control area, so it is unnecessary to construct a new flood control dam. However, rainwater collection and cut-off measures should be taken during site clearing in order to prevent the dispersion of pollutants.	OP 4.37 Dam Safety	
V	**IMMIGRATION AND LAND ACQUISITION**						
9	Whether the project needs to acquire land (public or private, temporary or permanent) due to development need?		√		The Site is clearly owned by Ganshui Supply and Marketing Cooperative and is not leased currently and the clearing and evacuation area of the Site is small, so land acquisition is not required.	OP 4.12 Involuntary Immigration	
10	Whether anyone is prohibited from using any economic resource (such as pasture, fishing place and forest) which they use daily?		√		There is no economic resource within the Site.	OP 4.12 Involuntary Immigration	

Screening item		Yes	No	Un known	Description	Policy of the World Bank adopted if the answer is yes	Document requirements (If the answer is “yes”)
11	Whether the project forces any individual or family to immigrate?		√		A family lives around the Site, a temporary settlement plan is implemented after the project organization and the management unit reach an agreement with the family, so there is no involuntary immigration of any individual or family.	OP 4.12 Involuntary Immigration	
12	Whether the project causes any temporary or permanent damage to any crop, fruit tree and household facility (such as barn, external toilet and kitchen)?		√		There is no crop, fruit tree and the like in the Site, but the walls of the house of a family living around the Site may be destroyed and shared walls will be reinforced during the implementation of the temporary settlement plan.	OP 4.12 Involuntary Immigration	
VI	**Minorities**						
13	Whether the project possibly has any adverse impact on tribal communities or vulnerable groups living in this area?		√		Residents around the Site belong to Han nationality and no minority lives here.	OP 4.10 Minorities	
14	Whether the group members living in this area benefit from the Project?		√		The Site is not the living area of minorities, so there is no minority benefiting from the Project.	OP 4.10 Minorities	

Screening item		Yes	No	Un known	Description	Policy of the World Bank adopted if the answer is yes	Document requirements (If the answer is "yes")
15	Whether any minority community is located within the Site and may be affected by the subproject?		√		The Site is not the living area of minorities, so no minority will be affected by site clearing.	OP 4.10 Minorities	

Table 4 Screening Result of Safety Guarantee Documents

Classification	**A**
Safety guarantee documents needing to be prepared:	Polluted site-specific environmental assessment (including environmental management plan)

Screened by: Wang Shijie ; Screening date: 2014-6-17

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

1. Geography

Tips for investigation contents: geographic position of the site; surrounding residential area; industrial facilities; rivers, streams, protection zone and pumping well, etc; topographic map; aerial view or satellite photo.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

2. Plant pollution layout

Tips for investigation contents: plant layout, including workshop and production line. Warehouse, etc. (past and present); storage location of hazardous chemicals (including solvent and oils, etc.); storage characteristics of wastes; stacking area and temporary storing area (including existing stacking area and abandoned stacking area, and field discharge system (sewage and rainwater pipe network)) of wastes within plant and their discharge point; underground tank location.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

3. Process and pollution emission

Tips for investigation contents: plant production process layout, historical major process change; discharge point and discharge direction of solids, liquid, wastewater and gas pollutants in the production process.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

4. Environmental approvals

Tips for investigation contents: project approval (including project expansion) on environment, health and safety matters, for example:

a. Environmental impact assessment (EIA) report or environmental impact assessment table;
b. Project review or approval documents;
c. "Three simultaneities:" review report, "three simultaneities" completion acceptance report.

Pollutant discharge registration and pollutant discharge permit approved and issued by the Environmental Protection Bureau, for example:

a. Pollutant Discharge Registration Form;
b. Pollutant discharge registration form issued by the Environmental Protection Bureau;
c. Pollutant discharge permit.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

5. Monitoring report

Tips for investigation contents: various monitoring reports and analysis reports issued by Environmental Monitoring Center, official bodies or third party, including sewage discharge, discharge of gases from chimneys, air quality of working area, monitoring conditions of soil and underground water.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

6. Hydrogeololgy

Tips for investigation contents: hydrogeological condition and engineering-geology condition of relevant site and surroundings.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

7. Chemicals/hazardous chemicals

Tips for investigation contents: list of chemicals used within the plant, including but not limited to: solid, liquid, oils and gas, etc.; detailed list of 10-year usage before suspension of production.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

8. Wastes/hazardous wastes

Tips for investigation contents: list and quantity of garbage and all wastes, with historical records required for those identified as hazardous wastes.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

9. Storage tank

Tips for investigation contents:

a. Sealing test (underground tank monitoring report);
b. Related records of contractor for outward transport of wastes, including five receipts for transport of hazardous wastes;
c. Storage of hazardous wastes;
d. Storage amount and storage contents of large tanks;
e. Storage and using years and monthly throughout;
f. Alarm, ventilation pump and protection measures corresponding to large tanks;
g. Written procedures for assembling and disassembling of large tanks.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

10. PCBs

Tips for investigation contents: historical use and treatment.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

11. Wastewater disposal

Tips for investigation contents: wastewater treatment station, wastewater discharge pipeline and wastewater discharge.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

12. Waste gas disposal

Tips for investigation contents: waste gas treatment station, waste gas discharge method and waste gas fate.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

13. Environment, health and safety procedures

Tips for investigation contents: (the investigator should meet the Environmental Protection Bureau, Labor Bureau and department of health when making field investigation) local policies and regulations, project approval, fire, chemical safety, electric safety, equipment safety, industrial safety management, personal protective articles and other relevant procedures on environment, health and safety matters.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

14. Environmental accident

Tips for investigation contents: violation of environmental laws and regulations, pollutants over-discharged, fines and pollution accident as well as official information exchange records and documents; emergency response plan; such as the records and remedial measures for splashing, leakage, accidental emissions to the atmosphere and other accidents.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

15. Complaints

Tips for investigation contents: provide detailed records and treatment results in case of complaints.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

16. Water

Tips for investigation contents: use details of water, including source; water quality analysis data, adopted pretreatment technology; annual usage of industrial water and domestic water.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

1. Geography

Tips for investigation contents: geographic position of the site; surrounding residential area; industrial facilities; rivers, streams, protection zone and pumping well, etc; topographic map; aerial view or satellite photo.

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e. Storage and using years and monthly throughout;

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g. Written procedures for assembling and disassembling of large tanks.

Exploration questionnaires of the Ganshui site

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Exploration questionnaires of the Ganshui site

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Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
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Tips for investigation contents: waste gas treatment station, waste gas discharge method and waste gas fate.

Exploration questionnaires of the Ganshui site

Name of the site	
Investigation time	
Site location	
Investigator	

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Tips for investigation contents: (the investigator should meet the Environmental Protection Bureau, Labor Bureau and department of health when making field investigation) local policies and regulations, project approval, fire, chemical safety, electric safety, equipment safety, industrial safety management, personal protective articles and other relevant procedures on environment, health and safety matters.

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Tips for investigation contents: use details of water, including source; water quality analysis data, adopted pretreatment technology; annual usage of industrial water and domestic water.

环境现场一期调查记录

场地名称	重庆綦江区典型杀虫剂类POPs存放点原址场地
调查时间	2012.11.21
调查地点	綦江区古南镇、东溪镇、赶水镇
调查人员	高焕方、谭以冬

1、地理

调查内容提示：现场的地理位置，周围居民区，工业设施，江河，溪流和保护区，取水水井等。地形图，航测图或卫星照片。

重庆綦江区地跨东经106°23′～107°03′、北纬28°27′～29°11′之间，东、北、西分别与重庆市南川、巴南、江津三区接壤，南与贵州省习水、桐梓两县接壤。

古南镇农资连锁公司农药仓库地处东经106°39′20.14″～106°39′21.79″、北纬29°01′33.90″～29°01′34.83″之间，其原址场地位于綦江县孟家院公铁立交桥下，西临渝黔铁路。

东溪镇位于四川盆地的东南边缘，贵州大娄山脉北端，地处重庆市綦江县城以南，直距綦江县城30公里，南距赶水8公里。东溪镇大雄殿仓库地处东经106°39′26.33″～106°39′27.26″、北纬28°45′59.86″～28°46′0.73″之间。

赶水镇位于綦江区南部，东邻万盛经开区和本区扶欢镇，南与贵州桐梓县交界，西与贵州习水县和本县打通、安稳两镇相连，北与本区东溪镇接壤。赶水供销社农资仓库地处东经106°42′11.53″～106°42′12.57″、北伟28°44′57.22″～28°44′58.18″之间。

环境现场一期调查记录

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调查人员	高焕方、谭从岑

2、 工厂污染布局

调查内容提示：工厂布局图，包括车间、生产线。仓库等（过去和现在）；危险化学品（包括溶剂、油类等）的储存位置；废物存放特点；厂内废物堆放点和临时存放区域（包括现存的堆放区和废弃的堆放区）；现场排放系统（污水和雨水管网）及其排放点；地下储罐位置。

古南镇农资连锁公司农药仓库占地面积约1320m²，共2层，早期1楼和2楼都曾存放农药，从2001年开始，仓库2楼和1楼东部出租给家具厂，只余仓库1楼西部继续堆放农药。

东溪镇大雄殿仓库占地面积约622m²，农药仓库位于其西南方，占地面积约82m²。除农药仓库外，其余库房用于堆放铁锅、箩筐、扁担等物品。

赶水供销社农资仓库占地面积约667m²，农药仓库位于其西北方，占地面积约50m²。除农药仓库外，其余库房用于堆放箩筐、扁担、麻绳等物品。

环境现场一期调查记录

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调查地点	綦江区古南镇、东溪镇、赶水镇
调查人员	高焕方、谭小参

3、工艺、污染排放

调查内容提示：工厂生产情况的生产工艺布局，历史上的重大工艺变化；生产工艺中的固体、液体、废水、气体污染物的排放点和排放去向。

三处场地均为农药仓库，无生产活动。

农药装卸和贮存过程中，可能因包装破损带来农药的泄漏和挥发。

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调查人员	高焕方，谭以岑

4、环境许可

调查内容提示：有关环境、卫生和安全事项的项目许可（包括项目扩建），例如：

a. 环境影响评价（EIA）报告或者环境影响评价表；
b. 项目审核或审批的文件；
c. “三同时”审核报告，“三同时”竣工验收报告。

由环保局批准并颁发的排污登记和排污许可，例如：

a. 污染排放登记表；
b. 由环保局颁发的排污登记表；
c. 排污许可证。

无

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调查人员	高焕方、梁丽玲

5、监测报告

调查内容提示：由环境监测中心、官方机构或第三方颁发的各项监测报告和分析报告，包括污水排放、烟囱气体排放、工作区域的空气质量、土壤和地下水监测情况。

无

环境现场一期调查记录

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调查时间	2012.11.21
调查地点	綦江区古南镇、东溪镇、赶水镇
调查人员	商焕方、谭以玲

6、水文地质

调查内容提示：有关场地和周边的水文地质情况、工程地质情况。

綦江境内溪河纵横，水系发达。綦江河系境内第一大河流、为长江一级支流，全长231.5公里。綦江河在赶水镇以上上游流域面积2943.4平方公里，赶水以下至古南中游流域面积1737.4平方公里。綦江河大小支流30多条，流域面积100平方公里以上的有洋渡河、藻渡河、扶欢河、郭扶河、蒲河、三角河和清溪河。

古南镇农资连锁公司农药仓库原址场地南距綦江河约350m；东溪镇大雄殿仓库北距东丁河约90m；赶水供销社农资仓库东距綦江河约80m。

三处仓库所在地浅层地下水不发育，附近居民和企业均使用自来水。

环境现场一期调查记录

场地名称	重庆綦江区典型杀虫剂类POPs存放点原址场地
调查时间	2012.11.21
调查地点	綦江区古南镇、东溪镇、赶水镇
调查人员	高焕方、谭旧琴

7、化学品／危险化学品

调查内容提示：厂内使用的化学品清单，包括但不局限于：固体、液体、油类、气体等，并收集停产前10年使用量的明细清单。

古南镇农资连锁公司农药仓库主要库存农药：

滴滴涕	5-6吨	六六六	2-3吨
甲胺磷	2.5吨	乐果	1吨
敌杀死	2吨	氧化乐果	1.5吨

东溪镇大雄殿仓库主要库存农药：

滴滴涕	0.7吨	六六六	1-2吨
敌敌畏	0.3吨	草甘膦	0.2吨

赶水供销社农资仓库主要库存农药：

滴滴涕	0.5吨	六六六	1吨
敌敌畏	0.2吨	甲胺磷	0.3吨
乐果	0.3吨	氧化乐果	0.5吨

环境现场一期调查记录

场地名称	重庆綦江区典型杀虫剂类POPs存放点原址场地
调查时间	2012.11.21
调查地点	綦江区古南镇、东溪镇、赶水镇
调查人员	高焕方、谭凯玲

8、 废物 / 危险废物

调查内容提示：垃圾和所有废物的清单和数量，被鉴别为危险废物的需要有历史记录。

调查场地无生产固废，仅有少量职工生活垃圾。原仓库内废弃农药为危险废物，调查时已经清理。

环境现场一期调查记录

场地名称	重庆綦江区典型杀虫剂类POPs存放点原址场地
调查时间	2012.11.21
调查地点	綦江区古南镇、东溪镇、赶水镇
调查人员	高焕方、谭以岑

9、储罐

调查内容提示：

a. 密封性测试（地下储罐监测报告）；

b. 合同商进行废物外运的相关记录，包括危险废物运输五联单；

c. 危险废物的存储；

d. 大型储罐的存储量和存储内容；

e. 存储使用年数和每月的吞吐量；

f. 与大型储罐相应的警报、通风泵和相应的保护措施；

g. 大型储罐装卸的书面程序。

无

环境现场一期调查记录

场地名称	重庆綦江区典型杀虫剂类POPs存放点原址场地
调查时间	2012.11.21
调查地点	綦江区古南镇、东溪镇、赶水镇
调查人员	高焕方、谭凤玲

10、 PCBs

调查内容提示：历史上的使用及处理情况。

无

环境现场一期调查记录

场地名称	重庆綦江区典型杀虫剂类POPs存放点原址场地
调查时间	2012 . 11 . 21
调查地点	綦江区古南街道、东溪镇、赶水镇
调查人员	高焕方、谭田玲

11、　废水处置

调查内容提示：废水处理站、废水排放管道、废水排放。

三处农药仓库仅有极少量生活废水排放、未采取治理措施。

环境现场一期调查记录

场地名称	重庆綦江区典型杀虫剂类POPs存放点原址场地
调查时间	2012.11.21
调查地点	綦江区古南镇、东溪镇、赶水镇
调查人员	高焕方、谭怀琴

12、　　废气处置

调查内容提示：废气处理站、废气排放方式、废气去向。

在农药包装破损时，可能存在农药的挥发，为无组织排放，未采取治理措施。

环境现场一期调查记录

场地名称	重庆綦江区典型杀虫剂类POPs存放与停止场地
调查时间	2012. 11.21
调查地点	綦江区古南镇、东溪镇、赶水镇
调查人员	高焕芳、谭[illegible]

13、　环境、卫生和安全程序

调查内容提示：（在调查人员作现场调查时需要与环保局、劳动局和卫生部门会面）有关环境、卫生和安全事务的地方政策、法规、项目许可、消防、化学安全、电力安全、设备安全、工业安全管理和个人防护用品等相关程序。

无

环境现场一期调查记录

场地名称	重庆綦江区典型杀虫剂类POPs存放点原址场地
调查时间	2012.11.21
调查地点	綦江区古南镇、东溪镇、赶水镇
调查人员	高顺为，谭世兴

14、　环境事故

调查内容提示：违反环境法律法规、环境排放超标、罚款和污染事故及官方的信息交流记录和文件；应急响应计划；如对溅出、泄漏，大气事故性排放等的事故记录和补救措施。

无

环境现场一期调查记录

场地名称	重庆綦江区典型杀虫剂类POPs存放点原址场地
调查时间	2012.11.21
调查地点	綦江区古南镇、东溪镇、赶水镇
调查人员	高焕方、谭以琴

15、　　投诉

调查内容提示：如果有投诉事件发生，提供详情记录和处理结果。

无

环境现场一期调查记录

场地名称	重庆綦江区典型杀虫剂类POPs存放与库址场地
调查时间	2012.11.21
调查地点	綦江区古南镇、东溪镇、赶水镇
调查人员	高焕方、谭晓

16、　用水

调查内容提示：水的使用详情，包括：来源；水质分析数据；采用的预处理技术；工业用水和生活用水年度使用量。

三处仓库仅有少量生活用水供使用，均使用自来水。

钻探取样记录

项目名称	重庆綦江区典型杀虫剂类POPs存放点原址场地环境风险评估报告		
场地地点	赶水供销社农资仓库		
钻号	赶水1#	日期	2012.12.4
钻进方法	挖掘	钻孔范围	0.4m×0.4m
钻孔坐标	N：28°44′57.92″ E：106°42′12.16″	钻点地面标高	300.46m
总钻深	0.4m	初见水位	未见

钻探（m）	取样深度（m）	柱状示意	土壤观察描述
+0.10		▒	混凝土地表
0.00		▒	混凝土地表
0.10		▨	以砂土为主的土层呈红褐色
0.20	0.2	▨	以砂土为主的土层呈红褐色
0.30		▨	以砂土为主的土层呈红褐色

钻探取样记录

项目名称	重庆綦江区典型杀虫剂类POPs存放点原址场地环境风险评估报告		
场地地点	赶水供销社农资仓库		
钻号	赶水2#	日期	2012.12.4
钻进方法	挖掘	钻孔范围	0.3m×0.3m
钻孔坐标	N：28°44′57.63″ E：106°42′12.00″	钻点地面标高	300.88m
总钻深	0.3m	初见水位	未见

钻探（m）	取样深度（m）	柱状示意	土壤观察描述
0.00			土壤地表
0.10		▩	以粘土为主的土层呈红褐色
0.20	0.2	▩	以粘土为主的土层呈红褐色
0.30		▩	以粘土为主的土层呈红褐色

Soil Sampling Record

Project name			
Location/place			
Drilling No.		Date	
Drilling method		Borehole range	
Borehole coordinates		Ground elevation of drill point	
Total drilling depth		Initial water level	
Drilling (m)	Sampling depth (m)	Columnar schematic	Soil description

Soil Sampling Record

Project name			
Location/place			
Drilling No.		Date	
Drilling method		Borehole range	
Borehole coordinates		Ground elevation of drill point	
Total drilling depth		Initial water level	
Drilling (m)	Sampling depth (m)	Columnar schematic	Soil description

Soil Sampling Record

Project name			
Location/place			
Drilling No.		Date	
Drilling method		Borehole range	
Borehole coordinates		Ground elevation of drill point	
Total drilling depth		Initial water level	
Drilling (m)	Sampling depth (m)	Columnar schematic	Soil description

Soil Sampling Record

Project name			
Location/place			
Drilling No.		Date	
Drilling method		Borehole range	
Borehole coordinates		Ground elevation of drill point	
Total drilling depth		Initial water level	
Drilling (m)	Sampling depth (m)	Columnar schematic	Soil description

Annex 4 Sampling pictures of the Ganshui site

Ganshui D1#

Ganshui D2#

Ganshui D3#

Ganshui D4#

Ganshui D5#

Ganshui D6#

Ganshui D9#

Annex 4 Sampling pictures of the Ganshui site


Ganshui D1#


Ganshui D2#


Ganshui D3#


Ganshui D4#


Ganshui D5#

Ganshui D6#

Ganshui D9#

Annex 5 Pictures of site measurement on the Ganshui Site

Turning point

Positions determination

Positions determinatio

Positions determinatio

Annex 5 Pictures of site measurement on the Ganshui Site

Turning point

Positions determination

Positions determinatio

Positions determinatio

资质认定

计量认证证书

证书编号： 2011090938Z

名称： 通标标准技术服务（上海）有限公司

地址： 上海市徐汇区宜山路８８９号3幢1层整层，2层C、E单元，4层C、D、E单元，5层D、E、C2单元，6层C、D单元，
层，8层D、E单元，9层C、D、E单元，１０层整层，4幢3层C、D单元，4层整层，7层D西单元，１０层C单元北侧、

实验室地址： 上海市浦东新区康桥东路1159弄69号，上海市松江区新桥镇金都西路588号，上海市宜山路889号，上海化学工业区神工路联合路华宝
门，上海化学工业区普工路88号，上海外高桥随塘路28号

经审查，你机构已具备国家有关法律、行政法规规定的基本条件和能力，现予批准，可以向社会出具具有证明作用的数据和结果，特发此证。

检测能力见证书附表。

准许使用徽标

CMA

2011090938Z

发证日期： 2013年08月12日

有效期至： 2014年12月26日

发证机关： 上海市质量技术监督局

本证书由国家认证认可监督管理委员会制定，在中华人民共和国境内有效

中国合格评定国家认可委员会

实验室认可证书

（注册号：CNAS L0599）

兹证明：

通标标准技术服务（上海）有限公司检测中心

上海市宜山路 889 号 3 号楼 1/4/6/7/8/9/10 楼，200233

符合 ISO/IEC 17025：2005《检测和校准实验室能力的通用要求》（CNAS-CL01《检测和校准实验室能力认可准则》）的要求，具备承担本证书附件所列检测和校准服务的能力，予以认可。

获认可的能力范围见标有相同认可注册号的证书附件，证书附件是本证书组成部分。

签发日期：2011-07-27

有效期至：2014-07-26

初次认可：2003-08-01

更新日期：2011-07-27

中国合格评定国家认可委员会授权人

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No.CNAS AL 1

0001631

China National Accreditation Service for Conformity Assessment

LABORATORY ACCREDITATION CERTIFICATE

(Registration No. CNAS L0599)

SGS-CSTC Standards Technical Services(Shanghai) Co., Ltd.
Testing Center
No.889, Yishan Road, Xuhui District, Shanghai, China

is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories(CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) *for the competence of testing and calibration.*

The scope of accreditation is detailed in the attached appendices bearing the same registration number as above. The appendices form an integral part of this certificate.

Date of Issue：2014-07-15
Date of Expiry：2017-07-14
Date of Initial Accreditation：2003-08-01
Date of Update：2014-07-15

Signed on behalf of China National Accreditation Service
for Conformity Assessment

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No.CNAS AL 2

0010225

2011090938Z

Testing
CNAS L0599

TEST REPORT

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Gao Huanfang	Manager	SGS-CSTC
Client	Chongqing University of Technology	Laboratory	Shanghai Enviromental Services
Address	No.69 Hongguang Avenue, Banan District, Chongqing 400054, CHINA	Address	2/F, 3RD BUILDING NO. 889, YISHAN ROAD, XUHUI DISTRICT, SHANGHAI, CHINA
Telephone	13508352906	Telephone	+86 (21) 6140 2666-2002
Facsimile	-	Facsimile	+86 (21) 6115 2164
Email	ghf1973@cqut.edu.cn	Email	REPORT.ENV @SGS.COM
Order Number	-	Report Number	SHENV12120194 R1
Samples	Soil(7)	SGS Reference	0000015305
Project	-	Date Reported	2012/12/27

COMMENTS

1.This test document cannot be reproduced in any way, except in full content, without prior approval in writing by the laboratory.
2.The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
3.The report is translated from SHENV12120194R0.
4.Project:Environmental Risk Assessment for the Typical Pesticidal POPs Contaminated Sites in Qijiang, Chongqing-1.

SIGNATORIES

LINDA LI
SENIOR CHEMIST

VIVIAN LI
ORGANIC TEAM SUPERVISOR

LYNN YANG
Authorized Signatory

		Sample Number	12120194.001	12120194.002	12120194.003
		Sample Name	gu nan 1#	gu nan 2#	gu nan 3#
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2012/12/14	2012/12/14	2012/12/14
Parameter	Units	LOR			

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	89.7	93.0	86.1

		Sample Number	12120194.001	12120194.002	12120194.003
		Sample Name	gu nan 1#	gu nan 2#	gu nan 3#
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2012/12/14	2012/12/14	2012/12/14
Parameter	Units	LOR			

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	7.8	7.5	8.1

		Sample Number	12120194.004	12120194.005	12120194.006
		Sample Name	gan shui 1#	gan shui 2#	dong xi 1#
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2012/12/14	2012/12/14	2012/12/14
Parameter	Units	LOR			

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	78.0	81.8	86.5

		Sample Number	12120194.004	12120194.005	12120194.006
		Sample Name	gan shui 1#	gan shui 2#	dong xi 1#
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2012/12/14	2012/12/14	2012/12/14
Parameter	Units	LOR			

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	7.6	4.3	3.6

		Sample Number	12120194.007
		Sample Name	dong xi 2#
		Sample Matrix	Soil
		Sample Description	-
		Receive Date	2012/12/14
Parameter	Units	LOR	

Soil. Determination of dry matter and water content. Gravimetric method Method: HJ 613-2011

Dry weight	%	-	87.5

		Sample Number	12120194.007
		Sample Name	dong xi 2#
		Sample Matrix	Soil
		Sample Description	-
		Receive Date	2012/12/14
Parameter	Units	LOR	

Examination of pH in Soil and castoff Method: USEPA 9045D-2004

pH	-	-	5.7

		Sample Number	12120194.001	12120194.002	12120194.003
		Sample Name	gu nan 1#	gu nan 2#	gu nan 3#
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2012/12/14	2012/12/14	2012/12/14
Parameter	Units	LOR			

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Parameter	Units	LOR	12120194.001	12120194.002	12120194.003
Arsenic (As)	mg/Kg	0.5	**2.2**	**2.3**	**3.0**
Cadmium(Cd)	mg/Kg	0.01	<0.01	<0.01	<0.01
Chromium(Cr)	mg/Kg	0.1	**22.8**	**28.0**	**27.8**
Copper(Cu)	mg/Kg	0.1	**8.6**	**7.5**	**8.5**
Lead (Pb)	mg/Kg	0.1	**21.4**	**27.7**	**30.2**
Nickel (Ni)	mg/Kg	0.1	**20.0**	**24.2**	**23.5**
Zinc (Zn)	mg/Kg	0.5	**47.6**	**51.3**	**55.0**

		Sample Number	12120194.001	12120194.002	12120194.003
		Sample Name	gu nan 1#	gu nan 2#	gu nan 3#
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2012/12/14	2012/12/14	2012/12/14
Parameter	Units	LOR			

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-1998

Parameter	Units	LOR	12120194.001	12120194.002	12120194.003
Mercury (Hg)	mg/Kg	0.01	**0.07**	**0.03**	**0.04**

		Sample Number	12120194.004	12120194.005	12120194.006
		Sample Name	gan shui 1#	gan shui 2#	dong xi 1#
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2012/12/14	2012/12/14	2012/12/14
Parameter	Units	LOR			

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Parameter	Units	LOR	12120194.004	12120194.005	12120194.006
Arsenic (As)	mg/Kg	0.5	**238**	**3.6**	**1.4**
Cadmium(Cd)	mg/Kg	0.01	<0.01	<0.01	<0.01
Chromium(Cr)	mg/Kg	0.1	**26.5**	**24.4**	**19.4**
Copper(Cu)	mg/Kg	0.1	**38.8**	**10.5**	**7.2**
Lead (Pb)	mg/Kg	0.1	**49.5**	**21.7**	**20.5**
Nickel (Ni)	mg/Kg	0.1	**18.9**	**16.3**	**9.9**
Zinc (Zn)	mg/Kg	0.5	**123**	**45.4**	**36.5**

Sample Number			12120194.004	12120194.005	12120194.006
Sample Name			gan shui 1#	gan shui 2#	dong xi 1#
Sample Matrix			Soil	Soil	Soil
Sample Description			-	-	-
Receive Date			2012/12/14	2012/12/14	2012/12/14
Parameter	Units	LOR			
Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-1998					
Mercury (Hg)	mg/Kg	0.01	**3.77**	**0.08**	**0.12**

Sample Number			12120194.007
Sample Name			dong xi 2#
Sample Matrix			Soil
Sample Description			-
Receive Date			2012/12/14
Parameter	Units	LOR	
Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A			
Arsenic (As)	mg/Kg	0.5	**1.0**
Cadmium(Cd)	mg/Kg	0.01	<0.01
Chromium(Cr)	mg/Kg	0.1	**15.7**
Copper(Cu)	mg/Kg	0.1	**6.9**
Lead (Pb)	mg/Kg	0.1	**17.2**
Nickel (Ni)	mg/Kg	0.1	**11.2**
Zinc (Zn)	mg/Kg	0.5	**36.7**

Sample Number			12120194.007
Sample Name			dong xi 2#
Sample Matrix			Soil
Sample Description			-
Receive Date			2012/12/14
Parameter	Units	LOR	
Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-1998			
Mercury (Hg)	mg/Kg	0.01	**0.36**

	Sample Number		12120194.001	12120194.002	12120194.003
	Sample Name		gu nan 1#	gu nan 2#	gu nan 3#
	Sample Matrix		Soil	Soil	Soil
	Sample Description		-	-	-
	Receive Date		2012/12/14	2012/12/14	2012/12/14
Parameter	Units	LOR			
OCP in soil GC-ECD Method: HJ 350-2007 Appendix G					
SURROGATES					
Tetrachloro-m-xylene	%	-	64	78	75
Decachlorobiphenyl	%	-	104	108	118
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
β-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
Heptachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	**0.03**	**0.02**	**0.02**
Dieldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDT	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan II	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01	<0.01

		Sample Number	12120194.001	12120194.002	12120194.003
		Sample Name	gu nan 1#	gu nan 2#	gu nan 3#
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2012/12/14	2012/12/14	2012/12/14
Parameter	Units	LOR			

OPP Method: USEPA 8141B-2007

SURROGATES					
Triphenyl phosphate	%	-	95	94	80
ORGANOPHOSPHOROUS PESTICIDES					
Dichlorvos	mg/Kg	0.01	<0.01	<0.01	<0.01
Demeton-O	mg/Kg	0.01	<0.01	<0.01	<0.01
Diazinon	mg/Kg	0.01	<0.01	<0.01	<0.01
Disulfoton	mg/Kg	0.01	<0.01	<0.01	<0.01
Parathion-methyl	mg/Kg	0.01	<0.01	<0.01	<0.01
Malathion	mg/Kg	0.01	<0.01	<0.01	<0.01
Fenthion	mg/Kg	0.01	<0.01	<0.01	<0.01
Chlorpyrifos	mg/Kg	0.01	<0.01	<0.01	<0.01
Parathion-ethyl	mg/Kg	0.01	<0.01	<0.01	<0.01
Pirimophos-ethyl	mg/Kg	0.01	<0.01	<0.01	<0.01
Chlorfenvinfos	mg/Kg	0.01	<0.01	<0.01	<0.01
Tokuthion	mg/Kg	0.01	<0.01	<0.01	<0.01
Fenamiphos	mg/Kg	0.01	<0.01	<0.01	<0.01
Ethion	mg/Kg	0.01	<0.01	<0.01	<0.01
Carbophenothion	mg/Kg	0.01	<0.01	<0.01	<0.01
Azinphos methyl	mg/Kg	0.01	<0.01	<0.01	<0.01
Chlorpyrifos-methyl	mg/Kg	0.01	<0.01	<0.01	<0.01
Methamidophos*	mg/Kg	0.1	<0.1	<0.1	<0.1
Demeton-S+Dimethoate	mg/Kg	0.01	<0.01	<0.01	<0.01
Bromophos-ethyl	mg/Kg	0.01	<0.01	<0.01	<0.01

		Sample Number	12120194.006	12120194.007
		Sample Name	dong xi 1#	dong xi 2#
		Sample Matrix	Soil	Soil
		Sample Description	-	-
		Receive Date	2012/12/14	2012/12/14
Parameter	Units	LOR		

Determination by GC/MS Method: Refer to USEPA 8270D

glyphosate	mg/Kg	0.025	<0.025	<0.025

		Sample Number	12120194.004	12120194.005	12120194.006
		Sample Name	gan shui 1#	gan shui 2#	dong xi 1#
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2012/12/14	2012/12/14	2012/12/14
Parameter	Units	LOR			

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES					
Tetrachloro-m-xylene	%	-	64	52	82
Decachlorobiphenyl	%	-	112	-	106
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	**1.10**	<0.01	<0.01
γ-BHC	mg/Kg	0.01	**0.11**	<0.01	<0.01
β-BHC	mg/Kg	0.01	**4.04**	**0.04**	<0.01
Heptachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	**0.21**	<0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01	<0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDE	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDE	mg/Kg	0.01	**0.15**	**0.01**	<0.01
Dieldrin	mg/Kg	0.01	<0.01	<0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin	mg/Kg	0.01	<0.01	<0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01	**0.01**	<0.01
o,p'-DDT	mg/Kg	0.01	**0.11**	**0.05**	**0.01**
Endosulfan II	mg/Kg	0.01	<0.01	<0.01	<0.01
p,p'-DDT	mg/Kg	0.01	**0.34**	**0.11**	**0.05**
Endrin aldehyde	mg/Kg	0.01	<0.01	<0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01	<0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01	<0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01	<0.01	<0.01

		Sample Number	12120194.004	12120194.005	12120194.006
		Sample Name	gan shui 1#	gan shui 2#	dong xi 1#
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2012/12/14	2012/12/14	2012/12/14
Parameter	Units	LOR			

OPP Method: USEPA 8141B-2007

SURROGATES					
Triphenyl phosphate	%	-	101	88	107
ORGANOPHOSPHOROUS PESTICIDES					
Dichlorvos	mg/Kg	0.01	<0.01	<0.01	<0.01
Demeton-O	mg/Kg	0.01	<0.01	<0.01	<0.01
Diazinon	mg/Kg	0.01	<0.01	<0.01	<0.01
Disulfoton	mg/Kg	0.01	<0.01	<0.01	<0.01
Parathion-methyl	mg/Kg	0.01	<0.01	<0.01	<0.01
Malathion	mg/Kg	0.01	<0.01	<0.01	<0.01
Fenthion	mg/Kg	0.01	<0.01	<0.01	<0.01
Chlorpyrifos	mg/Kg	0.01	**0.03**	<0.01	<0.01
Parathion-ethyl	mg/Kg	0.01	<0.01	<0.01	<0.01
Pirimophos-ethyl	mg/Kg	0.01	<0.01	<0.01	<0.01
Chlorfenvinfos	mg/Kg	0.01	<0.01	<0.01	<0.01
Tokuthion	mg/Kg	0.01	<0.01	<0.01	<0.01
Fenamiphos	mg/Kg	0.01	<0.01	<0.01	<0.01
Ethion	mg/Kg	0.01	<0.01	<0.01	<0.01
Carbophenothion	mg/Kg	0.01	<0.01	<0.01	<0.01
Azinphos methyl	mg/Kg	0.01	<0.01	<0.01	<0.01
Chlorpyrifos-methyl	mg/Kg	0.01	<0.01	<0.01	<0.01
Methamidophos*	mg/Kg	0.1	<0.1	<0.1	<0.1
Demeton-S+Dimethoate	mg/Kg	0.01	<0.01	<0.01	<0.01
Bromophos-ethyl	mg/Kg	0.01	<0.01	<0.01	<0.01

		Sample Number	12120194.007
		Sample Name	dong xi 2#
		Sample Matrix	Soil
		Sample Description	-
		Receive Date	2012/12/14
Parameter	Units	LOR	

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES			
Tetrachloro-m-xylene	%	-	68
Decachlorobiphenyl	%	-	89
ORGANOCHLORINE PESTICIDES			
α-BHC	mg/Kg	0.01	<0.01
γ-BHC	mg/Kg	0.01	<0.01
β-BHC	mg/Kg	0.01	**0.04**

		Sample Number	12120194.007
		Sample Name	dong xi 2#
		Sample Matrix	Soil
		Sample Description	-
		Receive Date	2012/12/14
Parameter	Units	LOR	

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

Heptachlor	mg/Kg	0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01
Aldrin	mg/Kg	0.01	<0.01
Heptachlor epoxide	mg/Kg	0.01	<0.01
γ-Chlordane	mg/Kg	0.01	<0.01
Trans-nonachlor	mg/Kg	0.01	<0.01
Endosulfan I	mg/Kg	0.01	<0.01
α-Chlordane	mg/Kg	0.01	<0.01
o,p'-DDE	mg/Kg	0.01	**0.02**
p,p'-DDE	mg/Kg	0.01	**0.01**
Dieldrin	mg/Kg	0.01	<0.01
o,p'-DDD	mg/Kg	0.01	<0.01
Endrin	mg/Kg	0.01	<0.01
Cis-Nonachlor	mg/Kg	0.01	<0.01
p,p'-DDD	mg/Kg	0.01	<0.01
o,p'-DDT	mg/Kg	0.01	**0.02**
Endosulfan II	mg/Kg	0.01	<0.01
p,p'-DDT	mg/Kg	0.01	<0.01
Endrin aldehyde	mg/Kg	0.01	<0.01
Endosulfan sulfate	mg/Kg	0.01	<0.01
Methoxychlor	mg/Kg	0.01	<0.01
Endrin ketone	mg/Kg	0.01	<0.01

		Sample Number	12120194.007
		Sample Name	dong xi 2#
		Sample Matrix	Soil
		Sample Description	-
		Receive Date	2012/12/14
Parameter	Units	LOR	

OPP Method: USEPA 8141B-2007

SURROGATES			
Triphenyl phosphate	%	-	76
ORGANOPHOSPHOROUS PESTICIDES			
Dichlorvos	mg/Kg	0.01	<0.01
Demeton-O	mg/Kg	0.01	<0.01
Diazinon	mg/Kg	0.01	<0.01
Disulfoton	mg/Kg	0.01	<0.01
Parathion-methyl	mg/Kg	0.01	<0.01

		Sample Number	12120194.007
		Sample Name	dong xi 2#
		Sample Matrix	Soil
		Sample Description	-
		Receive Date	2012/12/14
Parameter	Units	LOR	

OPP Method: USEPA 8141B-2007 (continued)

Malathion	mg/Kg	0.01	<0.01
Fenthion	mg/Kg	0.01	<0.01
Chlorpyrifos	mg/Kg	0.01	<0.01
Parathion-ethyl	mg/Kg	0.01	<0.01
Pirimophos-ethyl	mg/Kg	0.01	<0.01
Chlorfenvinfos	mg/Kg	0.01	<0.01
Tokuthion	mg/Kg	0.01	<0.01
Fenamiphos	mg/Kg	0.01	<0.01
Ethion	mg/Kg	0.01	<0.01
Carbophenothion	mg/Kg	0.01	<0.01
Azinphos methyl	mg/Kg	0.01	<0.01
Chlorpyrifos-methyl	mg/Kg	0.01	<0.01
Methamidophos*	mg/Kg	0.1	<0.1
Demeton-S+Dimethoate	mg/Kg	0.01	<0.01
Bromophos-ethyl	mg/Kg	0.01	<0.01

Remark:

1):Glyphosate、Methamidophos:Not certificated by CNAS/CMA

2):SHENV12120194.005:Some surrogate results were not reported due to matrix interference.

*** End of Report ***

LB1213973			LB1214114	
DUP	MS	MSD	MS	MSD
SHENV12120194.001	SHENV12120194.001	SHENV12120194.001	SHENV12120194.001	SHENV12120194.001

LB1214157			LB1214165
DUP	MS	MSD	DUP
SHENV12120194.001	SHENV12120194.001	SHENV12120194.001	SHENV12120194.001

MB blank results are compared to the Limit of Reporting

LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.

DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Lead (Pb)	LB1214114	mg/Kg	0.1	<0.1	3%	107%	102%	7%
Arsenic (As)	LB1214114	mg/Kg	0.5	<0.5	4%	107%	105%	2%
Cadmium(Cd)	LB1214114	mg/Kg	0.01	<0.01	0%	97%	93%	7%
Chromium(Cr)	LB1214114	mg/Kg	0.1	<0.1	8%	107%	89%	2%
Copper(Cu)	LB1214114	mg/Kg	0.1	<0.1	2%	99%	91%	13%
Nickel (Ni)	LB1214114	mg/Kg	0.1	<0.1	8%	106%	99%	8%
Zinc (Zn)	LB1214114	mg/Kg	0.5	<0.5	2%	90%	91%	8%

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-1998

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Mercury (Hg)	LB1214165	mg/Kg	0.01	<0.01	15%	86%

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Tetrachloro-m-xylene	LB1213973	%	-	50%	25%	59%	55%	21%
Decachlorobiphenyl	LB1213973	%	-	79%	21%	80%	88%	11%
α-BHC	LB1213973	mg/Kg	0.01	<0.01	0%	70%	74%	4%
γ-BHC	LB1213973	mg/Kg	0.01	<0.01	0%	71%	73%	4%
β-BHC	LB1213973	mg/Kg	0.01	<0.01	0%	72%	70%	9%
Heptachlor	LB1213973	mg/Kg	0.01	<0.01	0%	81%	76%	3%
δ-BHC	LB1213973	mg/Kg	0.01	<0.01	0%	71%	78%	14%
Aldrin	LB1213973	mg/Kg	0.01	<0.01	0%	70%	77%	4%
Heptachlor epoxide	LB1213973	mg/Kg	0.01	<0.01	0%	71%	81%	0%
γ-Chlordane	LB1213973	mg/Kg	0.01	<0.01	0%	71%	78%	3%
Trans-nonachlor	LB1213973	mg/Kg	0.01	<0.01	0%	79%	NA	NA
Endosulfan I	LB1213973	mg/Kg	0.01	<0.01	0%	73%	NA	NA
α-Chlordane	LB1213973	mg/Kg	0.01	<0.01	0%	79%	81%	5%
o,p'-DDE	LB1213973	mg/Kg	0.01	<0.01	0%	72%	NA	NA
p,p'-DDE	LB1213973	mg/Kg	0.01	<0.01	16%	72%	81%	17%

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

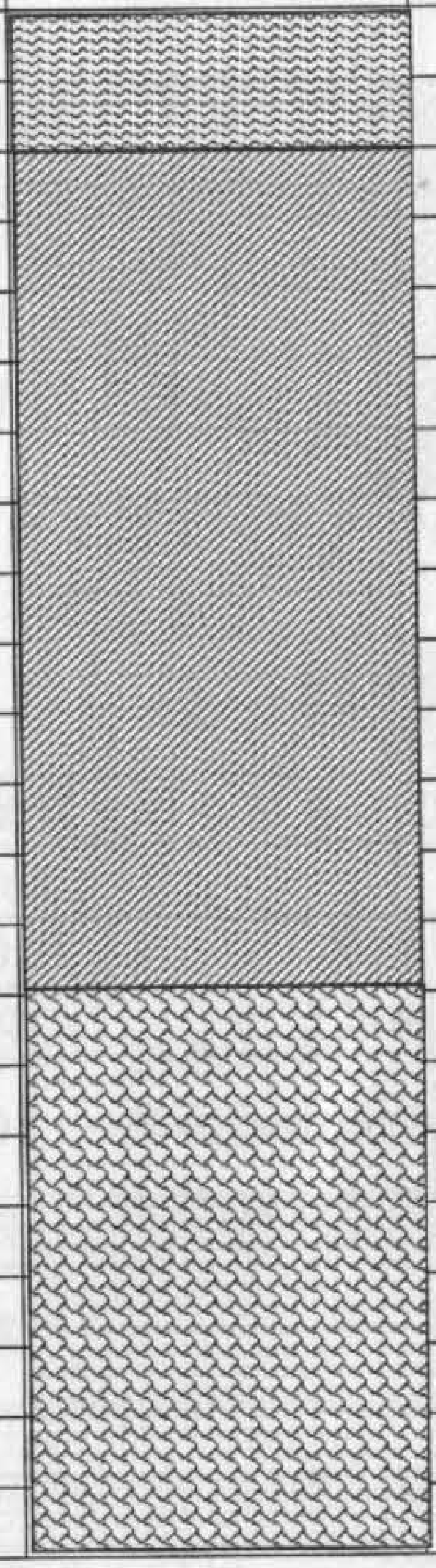
Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Dieldrin	LB1213973	mg/Kg	0.01	<0.01	0%	72%	84%	1%
o,p'-DDD	LB1213973	mg/Kg	0.01	<0.01	0%	80%	NA	NA
Endrin	LB1213973	mg/Kg	0.01	<0.01	0%	97%	106%	2%
Cis-Nonachlor	LB1213973	mg/Kg	0.01	<0.01	0%	79%	NA	NA
p,p'-DDD	LB1213973	mg/Kg	0.01	<0.01	0%	80%	96%	7%
o,p'-DDT	LB1213973	mg/Kg	0.01	<0.01	0%	84%	NA	NA
Endosulfan II	LB1213973	mg/Kg	0.01	<0.01	0%	71%	NA	NA
p,p'-DDT	LB1213973	mg/Kg	0.01	<0.01	0%	72%	103%	4%
Endrin aldehyde	LB1213973	mg/Kg	0.01	<0.01	0%	75%	NA	NA
Endosulfan sulfate	LB1213973	mg/Kg	0.01	<0.01	0%	74%	86%	9%
Methoxychlor	LB1213973	mg/Kg	0.01	<0.01	0%	100%	106%	0%
Endrin ketone	LB1213973	mg/Kg	0.01	<0.01	0%	79%	75%	3%

OPP Method: USEPA 8141B-2007

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Triphenyl phosphate	LB1214157	%	-	74%	24%	81%	79%	2%
Dichlorvos	LB1214157	mg/Kg	0.01	<0.01	0%	120%	94%	21%
Demeton-O	LB1214157	mg/Kg	0.01	<0.01	0%	90%	54%	4%
Diazinon	LB1214157	mg/Kg	0.01	<0.01	0%	120%	92%	13%
Disulfoton	LB1214157	mg/Kg	0.01	<0.01	0%	84%	78%	9%
Parathion-methyl	LB1214157	mg/Kg	0.01	<0.01	0%	86%	93%	1%
Malathion	LB1214157	mg/Kg	0.01	<0.01	0%	87%	87%	2%
Fenthion	LB1214157	mg/Kg	0.01	<0.01	0%	87%	83%	2%
Chlorpyrifos	LB1214157	mg/Kg	0.01	<0.01	0%	90%	84%	2%
Parathion-ethyl	LB1214157	mg/Kg	0.01	<0.01	0%	87%	86%	0%
Pirimophos-ethyl	LB1214157	mg/Kg	0.01	<0.01	0%	90%	82%	2%
Chlorfenvinfos	LB1214157	mg/Kg	0.01	<0.01	0%	75%	90%	0%
Tokuthion	LB1214157	mg/Kg	0.01	<0.01	0%	92%	83%	3%
Fenamiphos	LB1214157	mg/Kg	0.01	<0.01	0%	84%	81%	8%
Ethion	LB1214157	mg/Kg	0.01	<0.01	0%	87%	82%	2%
Carbophenothion	LB1214157	mg/Kg	0.01	<0.01	0%	86%	83%	5%
Azinphos methyl	LB1214157	mg/Kg	0.01	<0.01	0%	95%	122%	1%
Chlorpyrifos-methyl	LB1214157	mg/Kg	0.01	<0.01	0%	105%	81%	0%
Demeton-S+Dimethoate	LB1214157	mg/Kg	0.01	<0.01	0%	124%	118%	8%
Bromophos-ethyl	LB1214157	mg/Kg	0.01	<0.01	0%	91%	83%	3%

钻探取样记录

项目名称	重庆綦江区典型杀虫剂类POPs存放点原址场地环境风险评估报告		
场地地点	赶水供销社农资仓库		
钻号	赶水D1#	日期	2013.1.9
钻进方法	挖掘	钻孔范围	1.7m×0.8m
钻孔坐标	X：82739.411 Y：66350.079	钻点地面标高	300.618m
总钻深	2.1m	初见水位	未见

钻探（m）	取样深度（m）	柱状示意	土壤观察描述
+0.10			混凝土地表
0.00			混凝土地表
0.10			以砂土为主的土层呈红褐色
0.20			以砂土为主的土层呈红褐色
0.30			以砂土为主的土层呈红褐色
0.40			以砂土为主的土层呈红褐色
0.50	0.5		以砂土为主的土层呈红褐色
0.60			以砂土为主的土层呈红褐色
0.70			以砂土为主的土层呈红褐色
0.80			以砂土为主的土层呈红褐色
0.90			以砂土为主的土层呈红褐色
1.00	1.0		以砂土为主的土层呈红褐色
1.10			以砂土为主的土层呈红褐色
1.20			以砂土为主的土层呈红褐色
1.30			以粘土为主的土层呈红褐色
1.40			以粘土为主的土层呈红褐色
1.50	1.5		以粘土为主的土层呈红褐色
1.60			以粘土为主的土层呈红褐色
1.70			以粘土为主的土层呈红褐色
1.80			以粘土为主的土层呈红褐色
1.90			以粘土为主的土层呈红褐色
2.00	2.0		以粘土为主的土层呈红褐色

钻探取样记录

项目名称	重庆綦江区典型杀虫剂类POPs存放点原址场地环境风险评估报告		
场地地点	赶水供销社农资仓库		
钻号	赶水 D2#	日期	2013.1.9
钻进方法	挖掘	钻孔范围	0.4m×0.4m
钻孔坐标	X：82732.226 Y：66355.246	钻点地面标高	300.619m
总钻深	0.5m	初见水位	未见

钻探（m）	取样深度（m）	柱状示意	土壤观察描述
0.00			土壤地表
0.10		▨	以粘土为主的土层呈红褐色
0.20	0.2		以粘土为主的土层呈红褐色
0.30			以粘土为主的土层呈红褐色
0.40			以粘土为主的土层呈红褐色
0.50	0.5		以粘土为主的土层呈红褐色
0.60		▩	岩石

钻探取样记录

项目名称	重庆綦江区典型杀虫剂类POPs存放点原址场地环境风险评估报告		
场地地点	赶水供销社农资仓库		
钻号	赶水 D3#	日期	2013.1.9
钻进方法	土钻	钻孔范围	Φ50mm
钻孔坐标	X：82735.493 Y：66359.698	钻点地面标高	300.620m
总钻深	0.9m	初见水位	未见

钻探（m）	取样深度（m）	柱状示意	土壤观察描述
0.00			土壤地表
0.10		▨	以粘土为主的土层呈红褐色
0.20	0.2		以粘土为主的土层呈红褐色
0.30			以粘土为主的土层呈红褐色
0.40			以粘土为主的土层呈红褐色
0.50	0.5		以粘土为主的土层呈红褐色
0.60			以粘土为主的土层呈红褐色
0.70			以粘土为主的土层呈红褐色
0.80			以粘土为主的土层呈红褐色
0.90	0.9		以粘土为主的土层呈红褐色
1.00		▩	岩石

钻探取样记录

项目名称	重庆綦江区典型杀虫剂类POPs存放点原址场地环境风险评估报告		
场地地点	赶水供销社农资仓库		
钻号	赶水D4#	日期	2013.1.9
钻进方法	土钻	钻孔范围	Φ50mm
钻孔坐标	X：82743.056 Y：66350.001	钻点地面标高	300.012m
总钻深	0.2m	初见水位	未见

钻探（m）	取样深度（m）	柱状示意	土壤观察描述
0.00			土壤地表
0.10		▨	以砂土为主的土层呈褐色
0.20	0.2	▨	以砂土为主的土层呈褐色
0.30		▦	岩石

钻探取样记录

项目名称	重庆綦江区典型杀虫剂类POPs存放点原址场地环境风险评估报告		
场地地点	赶水供销社农资仓库		
钻号	赶水D5#	日期	2013.1.9
钻进方法	土钻	钻孔范围	Φ50mm
钻孔坐标	X：82738.802 Y：66346.768	钻点地面标高	300.022m
总钻深	0.4m	初见水位	未见

钻探（m）	取样深度（m）	柱状示意	土壤观察描述
0.00			土壤地表
0.10		▨	以砂土为主的土层呈红褐色
0.20	0.2	▨	以砂土为主的土层呈红褐色
0.30		▦	以粘土为主的土层呈红褐色
0.40	0.4	▦	以粘土为主的土层呈红褐色
0.50		▦	岩石

钻探取样记录

项目名称	重庆綦江区典型杀虫剂类POPs存放点原址场地环境风险评估报告		
场地地点	赶水供销社农资仓库		
钻号	赶水D6#	日期	2013.1.9
钻进方法	挖掘	钻孔范围	0.4m×0.4m
钻孔坐标	X：82725.845 Y：66352.881	钻点地面标高	300.625m
总钻深	0.5m	初见水位	未见

钻探（m）	取样深度（m）	柱状示意	土壤观察描述
0.00			土壤地表
0.10		▨	以粘土为主的土层呈红褐色
0.20	0.2	▨	以粘土为主的土层呈红褐色
0.30		▨	以粘土为主的土层呈红褐色
0.40		▨	以粘土为主的土层呈红褐色
0.50	0.5	▨	以粘土为主的土层呈红褐色
0.60		▨	岩石

钻探取样记录

项目名称	重庆綦江区典型杀虫剂类POPs存放点原址场地环境风险评估报告		
场地地点	赶水供销社农资仓库		
钻号	赶水D7#	日期	2013.1.9
钻进方法	土钻	钻孔范围	Φ50mm
钻孔坐标	X：82740.535 Y：66363.404	钻点地面标高	301.280m
总钻深	0.5m	初见水位	未见

钻探（m）	取样深度（m）	柱状示意	土壤观察描述
0.00			土壤地表
0.10		▨	以粘土为主的土层呈红褐色
0.20	0.2	▨	以粘土为主的土层呈红褐色
0.30		▨	以粘土为主的土层呈红褐色
0.40		▨	以粘土为主的土层呈褐色
0.50	0.5	▨	以粘土为主的土层呈褐色
0.60		▨	岩石

钻探取样记录

项目名称	重庆綦江区典型杀虫剂类 POPs 存放点原址场地环境风险评估报告		
场地地点	赶水供销社农资仓库		
钻号	赶水 D8#	日期	2013.1.9
钻进方法	土钻	钻孔范围	Φ50mm
钻孔坐标	X：82747.511 Y：66353.591	钻点地面标高	300.020m
总钻深	1.0m	初见水位	未见

钻探（m）	取样深度（m）	柱状示意	土壤观察描述
0.00			土壤地表
0.10		▩	以粘土为主的土层呈红褐色
0.20	0.2		以粘土为主的土层呈红褐色
0.30			以粘土为主的土层呈红褐色
0.40			以粘土为主的土层呈红褐色
0.50	0.5		以粘土为主的土层呈红褐色
0.60			以粘土为主的土层呈红褐色
0.70			以粘土为主的土层呈红褐色
0.80			以粘土为主的土层呈红褐色
0.90			以粘土为主的土层呈红褐色
1.00	1.0		以粘土为主的土层呈红褐色

钻探取样记录

项目名称	重庆綦江区典型杀虫剂类 POPs 存放点原址场地环境风险评估报告		
场地地点	赶水供销社农资仓库		
钻号	赶水 D9#	日期	2013.1.9
钻进方法	土钻	钻孔范围	Φ50mm
钻孔坐标	X：82732.911 Y：66342.789	钻点地面标高	300.632m
总钻深	1.0m	初见水位	未见

钻探（m）	取样深度（m）	柱状示意	土壤观察描述
0.00			土壤地表
0.10		▨	以砂土为主的土层呈红褐色
0.20	0.2		以砂土为主的土层呈红褐色
0.30			以砂土为主的土层呈红褐色
0.40		▩	以粘土为主的土层呈红褐色
0.50	0.5		以粘土为主的土层呈红褐色
0.60			以粘土为主的土层呈红褐色
0.70			以粘土为主的土层呈红褐色
0.80			以粘土为主的土层呈红褐色
0.90			以粘土为主的土层呈红褐色
1.00	1.0		以粘土为主的土层呈红褐色

TEST REPORT

CLIENT DETAILS

Contact	Gao Huanfang
Client	Chongqing University of Technology
Address	No.69 Hongguang Avenue, Banan District, Chongqing 400054, CHINA
Telephone	13508352906
Facsimile	-
Email	ghf1973@cqut.edu.cn
Order Number	-
Samples	Soil(10)
Project	-

LABORATORY DETAILS

Manager	SGS-CSTC
Laboratory	Shanghai Enviromental Services
Address	2/F, 3RD BUILDING NO. 889, YISHAN ROAD, XUHUI DISTRICT, SHANGHAI, CHINA
Telephone	+86 (21) 6140 2666-2002
Facsimile	+86 (21) 6115 2164
Email	REPORT.ENV @SGS.COM
Report Number	SHE13-00155 R1
SGS Reference	0000015307
Date Reported	2013/01/28

COMMENTS

1.This test document cannot be reproduced in any way, except in full content, without prior approval in writing by the laboratory.
2.The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
3.The report is translated from SHE13-00155R0.
4.Project:Environmental Risk Assessment for the Typical Pesticidal POPs Contaminated Sites in Qijiang, Chongqing-2

SIGNATORIES

LINDA LI
SENIOR CHEMIST

VIVIAN LI
ORGANIC TEAM SUPERVISOR

JUNE CAI
Authorized Signatory

		Sample Number	13-00155.002	13-00155.003	13-00155.004
		Sample Name	ganshuiD1#-2	ganshuiD1#-3	ganshuiD2#-1
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2013/01/15	2013/01/15	2013/01/15
Parameter	Units	LOR			

Soil. Determination of dry matter and water content. Gravimetric method **Method: HJ 613-2011**

Dry weight	%	-	83.3	83.7	87.6

		Sample Number	13-00155.005	13-00155.006	13-00155.007
		Sample Name	ganshuiD2#-2	ganshuiD3#-1	ganshuiD3#-2
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2013/01/15	2013/01/15	2013/01/15
Parameter	Units	LOR			

Soil. Determination of dry matter and water content. Gravimetric method **Method: HJ 613-2011**

Dry weight	%	-	88.8	79.2	81.8

		Sample Number	13-00155.008	13-00155.009	13-00155.010
		Sample Name	ganshuiD3#-3	ganshuiD4#-1	ganshuiD5#-1
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2013/01/15	2013/01/15	2013/01/15
Parameter	Units	LOR			

Soil. Determination of dry matter and water content. Gravimetric method **Method: HJ 613-2011**

Dry weight	%	-	81.2	92.6	79.6

		Sample Number	13-00155.011
		Sample Name	ganshuiD5#-2
		Sample Matrix	Soil
		Sample Description	-
		Receive Date	2013/01/15
Parameter	Units	LOR	

Soil. Determination of dry matter and water content. Gravimetric method **Method: HJ 613-2011**

Dry weight	%	-	84.9

		Sample Number	13-00155.002	13-00155.003	13-00155.004
		Sample Name	ganshuiD1#-2	ganshuiD1#-3	ganshuiD2#-1
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2013/01/15	2013/01/15	2013/01/15
Parameter	Units	LOR			
Mercury in solids and solutions by atomoc absorption spectrophotometry			**Method: USEPA 7473-1998**		
Mercury (Hg)	mg/Kg	0.01	**0.22**	**0.19**	**0.23**

		Sample Number	13-00155.002	13-00155.003	13-00155.004
		Sample Name	ganshuiD1#-2	ganshuiD1#-3	ganshuiD2#-1
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2013/01/15	2013/01/15	2013/01/15
Parameter	Units	LOR			
Appendix A Inductively coupled plasma-atomic emission spectrometry			**Method: HJ 350-2007 Appendix A**		
Arsenic (As)	mg/Kg	0.5	**5.8**	**3.2**	**1.0**

		Sample Number	13-00155.005	13-00155.006	13-00155.007
		Sample Name	ganshuiD2#-2	ganshuiD3#-1	ganshuiD3#-2
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2013/01/15	2013/01/15	2013/01/15
Parameter	Units	LOR			
Mercury in solids and solutions by atomoc absorption spectrophotometry			**Method: USEPA 7473-1998**		
Mercury (Hg)	mg/Kg	0.01	**0.08**	**0.06**	**0.22**

		Sample Number	13-00155.005	13-00155.006	13-00155.007
		Sample Name	ganshuiD2#-2	ganshuiD3#-1	ganshuiD3#-2
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2013/01/15	2013/01/15	2013/01/15
Parameter	Units	LOR			
Appendix A Inductively coupled plasma-atomic emission spectrometry			**Method: HJ 350-2007 Appendix A**		
Arsenic (As)	mg/Kg	0.5	**1.4**	**4.9**	**3.0**

		Sample Number	13-00155.008	13-00155.009	13-00155.010
		Sample Name	ganshuiD3#-3	ganshuiD4#-1	ganshuiD5#-1
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2013/01/15	2013/01/15	2013/01/15
Parameter	Units	LOR			

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-1998

Mercury (Hg)	mg/Kg	0.01	**0.09**	**0.06**	**0.13**

		Sample Number	13-00155.008	13-00155.009	13-00155.010
		Sample Name	ganshuiD3#-3	ganshuiD4#-1	ganshuiD5#-1
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2013/01/15	2013/01/15	2013/01/15
Parameter	Units	LOR			

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**1.6**	**2.2**	**7.9**

		Sample Number	13-00155.011
		Sample Name	ganshuiD5#-2
		Sample Matrix	Soil
		Sample Description	-
		Receive Date	2013/01/15
Parameter	Units	LOR	

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-1998

Mercury (Hg)	mg/Kg	0.01	**0.09**

		Sample Number	13-00155.011
		Sample Name	ganshuiD5#-2
		Sample Matrix	Soil
		Sample Description	-
		Receive Date	2013/01/15
Parameter	Units	LOR	

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**3.6**

		Sample Number	13-00155.002	13-00155.003	13-00155.004
		Sample Name	ganshuiD1#-2	ganshuiD1#-3	ganshuiD2#-1
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2013/01/15	2013/01/15	2013/01/15
Parameter	Units	LOR			

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES					
Tetrachloro-m-xylene	%	-	73	59	65
Decachlorobiphenyl	%	-	89	102	87
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	<0.01	**0.02**	**0.31**
γ-BHC	mg/Kg	0.01	<0.01	<0.01	**0.01**
β-BHC	mg/Kg	0.01	**0.02**	**0.08**	**0.62**
δ-BHC	mg/Kg	0.01	<0.01	<0.01	**0.01**

		Sample Number	13-00155.005	13-00155.006	13-00155.007
		Sample Name	ganshuiD2#-2	ganshuiD3#-1	ganshuiD3#-2
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2013/01/15	2013/01/15	2013/01/15
Parameter	Units	LOR			

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES					
Tetrachloro-m-xylene	%	-	61	61	68
Decachlorobiphenyl	%	-	110	88	84
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	**0.21**	**0.01**	**0.01**
γ-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
β-BHC	mg/Kg	0.01	**0.27**	**0.02**	**0.01**
δ-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01

		Sample Number	13-00155.008	13-00155.009	13-00155.010
		Sample Name	ganshuiD3#-3	ganshuiD4#-1	ganshuiD5#-1
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2013/01/15	2013/01/15	2013/01/15
Parameter	Units	LOR			

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES					
Tetrachloro-m-xylene	%	-	73	71	68
Decachlorobiphenyl	%	-	82	70	119
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
γ-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01

Parameter	Units	LOR			
		Sample Number	13-00155.008	13-00155.009	13-00155.010
		Sample Name	ganshuiD3#-3	ganshuiD4#-1	ganshuiD5#-1
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2013/01/15	2013/01/15	2013/01/15

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G (continued)

β-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01	<0.01	<0.01

Parameter	Units	LOR	
		Sample Number	13-00155.011
		Sample Name	ganshuiD5#-2
		Sample Matrix	Soil
		Sample Description	-
		Receive Date	2013/01/15

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES			
Tetrachloro-m-xylene	%	-	72
Decachlorobiphenyl	%	-	115
ORGANOCHLORINE PESTICIDES			
α-BHC	mg/Kg	0.01	<0.01
γ-BHC	mg/Kg	0.01	<0.01
β-BHC	mg/Kg	0.01	<0.01
δ-BHC	mg/Kg	0.01	<0.01

*** End of Report ***

LB1300717	LB1300735		
DUP	DUP	MS	MSD
SHE13-00155.001	SHE13-00155.001	SHE13-00155.001	SHE13-00155.001

LB1300762		
DUP	MS	MSD
QCO13-00024.003	QCO13-00024.003	QCO13-00024.003

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Appendix A Inductively coupled plasma-atomic emission spectrometry   Method: HJ 350-2007 Appendix A

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Arsenic (As)	LB1300735	mg/Kg	0.5	<0.5	0%	119%	114%	2%

Mercury in solids and solutions by atomoc absorption spectrophotometry   Method: USEPA 7473-1998

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Mercury (Hg)	LB1300717	mg/Kg	0.01	<0.01	8%	113%

OCP in soil   GC-ECD   Method: HJ 350-2007 Appendix G

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Tetrachloro-m-xylene	LB1300762	%	-	92%	4%	74%	57%	7%
Decachlorobiphenyl	LB1300762	%	-	77%	9%	98%	77%	2%
α-BHC	LB1300762	mg/Kg	0.01	<0.01	0%	77%	72%	0%
γ-BHC	LB1300762	mg/Kg	0.01	<0.01	0%	83%	73%	1%
β-BHC	LB1300762	mg/Kg	0.01	<0.01	0%	104%	76%	21%
δ-BHC	LB1300762	mg/Kg	0.01	<0.01	0%	88%	73%	4%

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Testing
CNAS L0599

TEST REPORT

CLIENT DETAILS / LABORATORY DETAILS

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Client	Chongqing University of Technology	Laboratory	Shanghai Enviromental Services
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Order Number	-	Report Number	SHE13-00394 R1
Samples	Soil(4)	SGS Reference	0000015308
Project	-	Date Reported	2013/05/17

COMMENTS

1.This test document cannot be reproduced in any way, except in full content, without prior approval in writing by the laboratory.
2.The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
3.The report is translated from SHE13-00394R0.
4.Project:Environmental Risk Assessment for the Typical Pesticidal POPs Contaminated Sites in Qijiang, Chongqing-3

SIGNATORIES

LINDA LI
SENIOR CHEMIST

VIVIAN LI
ORGANIC TEAM SUPERVISOR

DIANA YIN
Authorized Signatory

		Sample Number	13-00394.001	13-00394.002	13-00394.003
		Sample Name	ganshuiD6#-1	ganshuiD6#-2	ganshuiD9#-1
		Sample Matrix	Soil	Soil	Soil
		Sample Description	-	-	-
		Receive Date	2013/01/15	2013/01/15	2013/01/15
Parameter	Units	LOR			
Soil. Determination of dry matter and water content. Gravimetric method		**Method: HJ 613-2011**			
Dry weight	%	-	82.6	95.0	88.5

		Sample Number	13-00394.004
		Sample Name	ganshuiD9#-2
		Sample Matrix	Soil
		Sample Description	-
		Receive Date	2013/01/15
Parameter	Units	LOR	
Soil. Determination of dry matter and water content. Gravimetric method		**Method: HJ 613-2011**	
Dry weight	%	-	86.0

Sample Number			13-00394.001	13-00394.002	13-00394.003
Sample Name			ganshuiD6#-1	ganshuiD6#-2	ganshuiD9#-1
Sample Matrix			Soil	Soil	Soil
Sample Description			-	-	-
Receive Date			2013/01/15	2013/01/15	2013/01/15
Parameter	Units	LOR			

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**1.4**	**0.9**	**2.1**

Sample Number			13-00394.001	13-00394.002	13-00394.003
Sample Name			ganshuiD6#-1	ganshuiD6#-2	ganshuiD9#-1
Sample Matrix			Soil	Soil	Soil
Sample Description			-	-	-
Receive Date			2013/01/15	2013/01/15	2013/01/15
Parameter	Units	LOR			

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-1998

Mercury (Hg)	mg/Kg	0.01	**0.24**	**0.25**	**0.13**

Sample Number			13-00394.004
Sample Name			ganshuiD9#-2
Sample Matrix			Soil
Sample Description			-
Receive Date			2013/01/15
Parameter	Units	LOR	

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Arsenic (As)	mg/Kg	0.5	**2.5**

Sample Number			13-00394.004
Sample Name			ganshuiD9#-2
Sample Matrix			Soil
Sample Description			-
Receive Date			2013/01/15
Parameter	Units	LOR	

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-1998

Mercury (Hg)	mg/Kg	0.01	**0.34**

		Sample Number Sample Name Sample Matrix Sample Description Receive Date	13-00394.001 ganshuiD6#-1 Soil - 2013/01/15	13-00394.002 ganshuiD6#-2 Soil - 2013/01/15	13-00394.003 ganshuiD9#-1 Soil - 2013/01/15
Parameter	Units	LOR			

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES					
Tetrachloro-m-xylene	%	-	60	57	71
Decachlorobiphenyl	%	-	91	79	73
ORGANOCHLORINE PESTICIDES					
α-BHC	mg/Kg	0.01	<0.01	<0.01	**0.03**
γ-BHC	mg/Kg	0.01	<0.01	<0.01	**0.01**
β-BHC	mg/Kg	0.01	**0.02**	<0.01	**0.04**
δ-BHC	mg/Kg	0.01	<0.01	<0.01	**0.02**

		Sample Number Sample Name Sample Matrix Sample Description Receive Date	13-00394.004 ganshuiD9#-2 Soil - 2013/01/15
Parameter	Units	LOR	

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

SURROGATES			
Tetrachloro-m-xylene	%	-	50
Decachlorobiphenyl	%	-	83
ORGANOCHLORINE PESTICIDES			
α-BHC	mg/Kg	0.01	**0.01**
γ-BHC	mg/Kg	0.01	<0.01
β-BHC	mg/Kg	0.01	**0.03**
δ-BHC	mg/Kg	0.01	**0.01**

*** End of Report ***

LB1304545			LB1304586
DUP	MS	MSD	DUP
QCO13-00154.006	QCO13-00154.006	QCO13-00154.006	SHE13-00394.001

LB1304611		
DUP	MS	MSD
QCO13-00155.001	QCO13-00155.001	QCO13-00155.001

MB blank results are compared to the Limit of Reporting

LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.

DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Appendix A Inductively coupled plasma-atomic emission spectrometry Method: HJ 350-2007 Appendix A

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Arsenic (As)	LB1304611	mg/Kg	0.5	<0.5	3%	90%	93%	4%

Mercury in solids and solutions by atomoc absorption spectrophotometry Method: USEPA 7473-1998

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Mercury (Hg)	LB1304586	mg/Kg	0.01	<0.01	6%	102%

OCP in soil GC-ECD Method: HJ 350-2007 Appendix G

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Tetrachloro-m-xylene	LB1304545	%	-	55%	4%	61%	64%	8%
Decachlorobiphenyl	LB1304545	%	-	82%	6%	91%	88%	11%
α-BHC	LB1304545	mg/Kg	0.01	<0.01	0%	70%	72%	2%
γ-BHC	LB1304545	mg/Kg	0.01	<0.01	0%	78%	74%	2%
β-BHC	LB1304545	mg/Kg	0.01	<0.01	0%	86%	76%	2%
δ-BHC	LB1304545	mg/Kg	0.01	<0.01	0%	90%	75%	3%