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GEF- Reduction and phase-out of PFOS in priority sectors in China

Environmental & Social Management Framework

Foreign Economic Cooperation Office, Ministry of Environmental Protection (FECO)

Hubei Academy of Environmental Sciences (HAES)

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Contents

Part I Environmental Management Framework

Part II Social Management Framework

Abbreviations

PFOS	Perfluorooctane Sulfonic of acid and its salts
PFOSF	Perfluorooctane Sulfonyl Fluoride
POPs	Persistent Organic Pollutants
BAT	Best Available Technology
BEP	Best Environmental Practice
GEF	Global Environment Facility
WB	World Bank
FECO	Foreign Economic Cooperation Office
HAES	Hubei Academy Environmental Science
PID	Project Information Document
PMO	Project Management Office
NPMO	National Project Management Office
LPMO	Local Project Management Office
TOR	Terms of Reference
EMF	Environment Management Frame
PIU	Project Implementation Unit
PMP	Pest Management Plan
ESMP	Environment and Social Management Plan

Chapter 1. Background and Objectives

1.1 Background

In August 2013, the Standing Committee of the National People's Congress adopted the *Amendment to Annex A, B, and C* of Stockholm Convention on POPs which adds 9 POPs to the list and the *Amendment to Annex A* which adds endosulfan as a POP. *On* March 25, 2014, The Ministry of Environmental Protection (MEP) and other eleven ministries and commissions released a joint notice (No.[2014]21) for prohibiting the production, circulation, utilization and import & export of PFOS and PFOSF, except for specific exemptions and/ or acceptable purposes. China shall phase out the use of 6 exempt PFOS before the exemption expires on March 25, 2019, and conduct BAT/BEP in the seven PFOS-related industries which use PFOS with acceptable purposes, so as to phase out the production and use of PFOS.

In order to meet the requirements of the Stockholm Convention on POPs, the Foreign Economic Cooperation Office (FECO) and World Bank (WB) have developed the “GEF-Reduction and phase-out of PFOS in priority sectors in China". On June 4, 2015, the project obtained the approval of GEF. The project is about chemicals management aimed at helping China fulfill its mandatory obligation in phasing out of PFOS and its salts, as is stated in Stockholm Convention on POPs. The total investment of the project is $ 145.3 million, of which GEF grant is $ 24.25 million.

1.2 Objectives

According to the World Bank's safeguard policy, the potential impact/risk (and connotation) shall be predicted and evaluated for all activities supported by the World Bank, including the whole or part of the World Bank financed project. This requires first identifying the nature of the impact/risk, determine the class of environmental impact (class A, B or C specified in the World Bank's EIA) and take appropriate safeguard measures to avoid or mitigate negative impacts. By analyzing the range and degree of potential environmental impacts, this project is identified as class A.

The content of demonstration project can only be determined in the implementation process, so we formulate the Environmental Management Framework (EMF) to guide PMO at each level in screening and assessment of environmental impacts. The EMF has defined the requirement in areas such as selection of demonstration project, assessment and management procedures, institutional responsibilities and related procedures. The aim is to make sure the project implementation is in line with Chinese laws and regulations; as well WB's safeguard policies. It also provides guidance for potential participating enterprises and institutions, and clarifies the requirements for identification of demonstration projects, responsibilities during preparation and implementation phases, works to be done and related requirements.

Chapter 2. Project Description

The target sectors for PFOS phase-out are PFOS production industries and three PFOS application industries: electroplating, imported fire ant control and firefighting. The major content of the project is to close up or convert product of PFOS manufacturing enterprises, demonstrate pollution control, phase-out and substitution of PFOS in electroplating and pesticide industries, as well as demonstrate supervision capacity building in Hubei Province and Guangdong Province.

Specifically, it includes four components:

Component 1: Phase-out of PFOS manufacturing enterprises. Including:

1) To switch product of PFOS manufacturing enterprises, including: technology transfer, R & D, environmental characteristic screening of alternative products;

2) To conduct environmentally sound management of product changing of PFOS production enterprises, including: equipment investment, worker retraining, installation of security facilities, and BAT/BEP of cleaner production;

3) To provide support for existing PFOS production lines to introduce BAT/BEP of cleaner production;

4) To close production line for non-acceptable purposes, including the contamination assessment of production plant and its soil, and necessary cleanup work.

Component 2: Phase-out and substitution of PFOS application industries. Including:

(1) PFOS substitution in electroplating industry

1) To imitate technical demonstration for the closed system reformation of chrome-plating enterprises;
2) To initiate comprehensive technical demonstration for PFOS phase-out of electroplating industrial park: a) To investigate the chromium mist inhibitors used by chrome-plating enterprises in the park and make a list of PFOS-contained products; b) To use non-PFOS-contained chromium mist inhibitors in substitution of the PFOS-contained products; c) To minimize the use of chromium mist inhibitors; d) To add PFCs absorption equipment in sewage treatment plants in the park to improve sewage treatment technology; e) To carry out technical demonstration of trivalent chromium.
3) To investigate and evaluate the applications of trivalent chromium technology;
4) To regulate the production and use of chromium mist inhibitors;
5) Evaluate the technological economy and environment friendliness of alternatives products;
6) Improvement of relevant rules and regulations: a) to revise the local standard - *Discharge Standard of Water Pollutants for Electroplating*; b) to revise the standard - *Emission Standard of Pollutants for Electroplating*; c) to revise the standard - *Assessment Indicator Frame of Cleaner Production for Electroplating Industry*; d) to compile the standard - *Guideline on Best Available Technologies of POPs Pollution Prevention and Control for Chrome-plating Industry*; e) To implement the management mode of "pollutant discharge permit" for chrome-plating enterprises.

(2) PFOS substitution in imported fire ant prevention and control industry

1) To initiate technical demonstration of new products in substitution of Sulfluramid: to build imported fire ant prevention and control demonstration areas in five provinces, namely Guangxi, Yunnan, Hainan, Guangdong and Fujian, which are most seriously hit by imported fire ant, and on this basis, formulate standard operation guidelines and evaluate the technological economy of the alternatives products.
2) To enhance knowledge dissemination, including the prevention and control of imported fire ant and the hazards of POPs;
3) To choose potential alternativesalternatives products;
4) To arrange discussions and trainings on imported fire ant prevention and control and alternatives products (in substitution of Sulfluramid);
5) To revise technical standards and regulate the use of pesticides against imported fire ant: a) To work out the *Technical Scheme for Imported fire ant Prevention and Control* and the *Directory and Use Instructions of Pesticides against Imported fire ant*; b) To revise the *Technical Specifications for Chemical Prevention and Control of Imported fire ant* and carry out researches, e.g. international comparison concerning the registration of pesticides against imported fire ant and other quarantine pests and the supporting policies for PFOS phase-out in imported fire ant prevention and control industry.

(3) PFOS substitution in firefighting industry

1) Evaluation of applications of new products in substitution of foam extinguishing agent and the certification of new products;
2) Screening, research & development and application of alternatives products/technologies;
3) To improve PFOS regulatory capacity of firefighting industry: to establish PFOS substances regulation mechanism, build the PFOS substances tracking information system, and train the on-the-job personnel;
4) To collect BATs/BEPs from foam extinguishing agents used in firefighting drills.
5) To investigate and research the management of PFOS-contained foam concentrate products and the disposal of the expired products;

Component 3: PFOS management and regulatory framework. Including:

1) Policy and legislative support, including restrictions on the use and production of PFOS as stated in Stockholm Convention;
2) Implementing the PFOS environmental monitoring, supervision capability building;
3) To support the establishment of China PRTR (Pollutant Release and Transfer Registers) database;
4) To control the import and export of PFOS and PFOS-containing material / goods / products;
5) To carry out capacity building for feature screening of POPs alternatives;
6) To provide guidance on BAT/BEP and cleaner production to key departments through industrial associations and research institutions, and to provide support for technical training;
7) To update waste / wastewater standards of PFOS and PFOS-containing products and materials;

8) To provide identification/environmental certification of PFOS alternatives in the next project phase; and

9) To improve the consciousness of general public, industry practitioners and other users.

Component 4: Project management, monitoring and assessment.

This component is designed to monitor and evaluate the whole project (various industries) according to the requirements of the GEF and World Bank and grant funds for the establishment and normal operation of the national PMO at FECO and the provincial PMOs at the Environmental Protection Departments of project provinces.

Chapter 3. Main Processes and Its Environmental Impact

The global environment outlook (GEO) of this project is to reduce PFOS production and application in China. The implementation of this project will reduce production and application of PFOSF by 55 - 60 tons, significantly reduce the discharge of POPs, reduce environmental risks, enhance the supervising capacity of EPBs and public awareness of reducing the use of POPs, and eventually bring environmental benefits. Meanwhile, since the implementation of the project may bring negative impact on the environment, this EMF is formulated to identify the necessary environmental protection consultations according to the procedures specified in Chapter 5.

Current studies suggest that PFOS, of low volatility, has caused global pollution, so PFOS may have unique features different from common POPs. Research has shown that PFOS-contained components enter the atmosphere due to the vitality and decompose to generate PFOS when diffusing globally or entering specific environments. PFOS is very stable. It won't hydrolyze or photolyse and it won't biodegrade under natural conditions. So PFOS is accumulated in the bodies of organisms, and there is PFOS everywhere in the globe. Due to biological magnification and accumulation, the organisms at top of food chain have high-concentration PFOS in their bodies. PFOS has reproductive toxicity, mutagenicity and developmental toxicity and it may hurt multiple human organs.

3.1 Environmental impact of PFOS manufacturing industries

ECF is the main production process of PFOS-related substances. The PFOSF (product of electrolytic reaction) is a major intermediate for compounding PFOS. After hydrolysis, amidation, and quaternization reaction, various types of PFOS products are produced. Production process of PFOS: sulfonation- chlorination- fluorination- electrolyzation- rectification.

Chemical reactions that occurs during the electrolytic process:

Perfluoro-1-octanesulfonyl fluoride hydrofluoric acid PFOSF

$C_8H_{17}SO_2F + 17.1HF \rightarrow 0.7C_8F_{17}SO_2F + 0.1C_{10}F_{21}SO_2F + 0.1C_6F_{13}SO_2F + 0.1C_4F_9SO_2F + 0.05C_8F_{18} + 17H_2\uparrow$

Hydrogen

Fluoride-containing waste water and waste gas are the main environmental pollutants of the PFOS production industry; moreover, the waste water contains pollutants such as COD, NH3-H and chloride, while waste gas contains pollutants such as HCl, fly ash and SO_2.

After PFOS production enterprises switch products, it may produce new water pollutants. Solid wastes from PFOS production industry include general industrial solid waste, domestic waste and hazardous waste. Of which: general industrial solid waste shall be recycled for reutilization; domestic waste shall be sent to sanitary landfills for treatment. The main solid waste generated from the producing process, CaF_2 is the hazardous waste which code HW49. The hazardous waste shall be transported by qualified units to relevant hazardous waste disposal units. Moreover, PFOS product-switching enterprises have the risk of site pollution.

In addition, environmental risks may arise during product switching process of PFOS production enterprises, mainly including four aspects:

1) Toxicity and hazard of chemicals during the production and storage process; the risk of "three wastes" emitted by material, fuel, intermediate products, final products and production process;
2) Hazard in production equipment/process;
3) Risk factors in transportation/storage of dangerous goods;
4) System risks brought by auxiliary facilities and public works。

3.2 Environmental impact of PFOS application industries

In terms of PFOS application industries, the project mainly involves electroplating, pesticides and firefighting industry.

3.2.1 Application in electroplating

Electroplating is an important application industry of PFOS in China. PFOS mainly helps restrain the chromium fog generated by hard chrome plating and decorative chrome plating. In one hand, PFOS can significantly reduce the surface tension of bath solution, so as to help gases like H2, O2 runoff. In other hand, PFOS can make the surface of the bath solution form a dense foam layer, so as to help gases like H2, O2 runoff and entrain the overflow of CrO3. In this way, the loss of raw material is significantly reduced, and the physical nature and anti-corrosion ability of chrome layer is well preserved. This electroplating process brings significant economic benefits, so it is widely used in electroplating industry. However, due to its durability, toxicity, and bio-cumulativeness, PFOS's negative impact on environment cannot be ignored. Therefore, PFOS needs to be phased out and replaced. Possible alternative processes of PFOS include the following three kinds:

Closed-loop chromium plating process The key of closed loop system lies in the evaporative concentration of washing water containing chromium. After inclusion is removed, the concentrated solution will be send to the plating tank. Meanwhile, the washing water will be recycled. The chrome fog is collected, so there is no need for chrome fog inhibitor.

Cr3 chromium plating process We use Cr-III to replace conventional Cr-VI in this chromium plating process. The toxicity of CR-III is much lower than CR-VI. Besides, there is no need of chrome fog inhibitor in this process, and the wastewater is easy to handle. Currently, the hard chrome plating once applied in decorative chrome plating can no longer be used.

Alternative technology Chrome-free plating solution does not contain chromium salts. This technology uses Nickel-Tungsten alloy coating to replace chrome. The coating is only used in oil-contacting environment/conditions such as oil pipe fittings and machine parts.

PFOS used in the electroplating process owns good dispersion and wetting behavior, so it brings negative impact on the health of workers. Besides, the PFOS-containing chromium fog inhibitor belongs to non-depleting substance. It will be discharged as wastewater (containing heavy metals) and released into the environment. Hence, its toxicity will bring negative impact on human health and environment in a persistent, bio-accumulative way. Main environmental impacts of PFOS applications in electroplating industry include wastewater, waste gas and solid wastes as well as potential environmental risks.

The **wastewater** comes from cleaning water, filtration of plating solution, abandoned plating solution and the dripping, leakage and overflow of plating solution. The code of chromium contained hazardous wastes is H21. The wastewater includes: first, the waste

acid liquor, waste alkali liquor and waste organic solvents generated simultaneously with cleaning water in pre-plating processes, all of which are hazardous wastes (with codes: HW34, HW35 and HW42); second, the concentrated solution containing impurities left on bottom of plating bath after filtration of plating solution; third, the cleaning water of filter paper, filter cloth, filter element, filter and filter tank and the filter residues after filtration; fourth, the leakage during filtration process;

The **waste gas** includes the dust laden waste gas, acid waste gas, alkaline waste gas, chromium-contained waste gas and cyanogen-contained waste gas. **Dust laden waste gas**, usually containing grains of sand, metal oxides and fibrous dusts etc., is mainly produced from blasting, grinding and polishing processes. This type of waste gas will pollute the air and also hurt the throat and lungs of the workers. **Acid waste gas** mainly comes from acid pickling of workpieces and chromic acid mist near plating bath at electroplating workshop, and in the acid waste gas, there are micro bubbles containing acid liquor or chromic anhydride. **Alkaline waste gas** mainly comes from the alkaline substances used in electroplating process such as sodium hydroxide, sodium carbonate and sodium phosphate when these substances are heated in the following processes: chemically degreasing, electrochemically degreasing, strongly alkaline plating (e.g. alkaline zinc plating and alkaline tin plating) and cyanide electroplating. **Chromium-contained waste gas** (chromium mist) is highly toxic and corrosive and therefore has great adverse impacts on human health and environment. In addition, depending on the plating technology, some nitrogen oxide gas, hydrogen chloride gas, cyanide gas and benzene-contained waste gas may be generated.

Solid wastes mainly include the sludge at wastewater treatment station and some electroplating residues. Electroplating residues and sludge are hazardous heavy metal wastes and they shall be transported to the hazardous wastes disposal center and be disposed of properly. The code of nickel-contained waste liquid, waste residues and sludge is HW17, but separately, the code of nickel-contained waste liquid is HW42; the code of copper-contained waste liquid is HW22. Due to presence of cyanide, the silver-contained waste liquids and filter residues are deemed hazardous wastes, with code no. HW33.

Environmental risk: the electroplating plant has the risk of chemical leakage, so accident pool shall be built in case of any accident.

3.2.2 Application in pesticides

As a kind of pesticide substance, PFOS is mainly used in China for imported fire ant control, which is also a demonstration area in the project.

Fire ant belongs to hymenoptera. It is a kind of myrmicinae in formicidae. Fire ant in Latin means "invincible" ants, which means it is difficult to control. As its common name, "fire ant" means the sense of fire-burning after being bitten. As a typical invasive alien species, fire ant is highly destructive. Fire ant has strong aggressiveness and reproductivity. It can spread with the water, and it has no natural predators in China. As a kind of ant widely distributed in China, it has a proliferation tendency to spread from south to north.

As to drugs in fire ant control, only sulfluramid belongs to PFOS substances. The chemical name of sulfluramid is N-sulfluramid ethyl perfluorooctane sulfonamide. As an energy metabolism inhibitor for insect, it is mainly used as a kind of bait formulation for controlling cockroaches, termites, and fire ants. Sulfluramid is primarily made in reactive synthesis of PFOSF, amine, hydrochloric acid and related solvents.

As sulfluramid (PFOS substances) owns low price and good effect, it is widely used in fire ant control and eradication. However, use of sulfluramid-containing bait formulation can bring serious side effects to environment and human health such as long lasting pollution, bio-cumulativeness, and toxicity. Meanwhile, in its application process, improper operation may produce pesticide poisoning risk; besides, as discarded pesticides belongs to hazardous waste, improper disposal will result in water/soil pollution.

3.2.3 Application in fire fighting

PFOS has excellent thermal/chemical stability and compatibility. In fire protection industry, it is mainly used in aqueous film-forming foam (AFFF) for reducing the surface tension of fire-fighting foam, and improving its liquidity and phase permeability. However, the PFOS will remain in the natural environment after the use of fire-extinguishing foam. It may flow into surface water or groundwater, thus generating persistent pollution to water environment.

In addition, the discarded PFOS-contained extinguishing agents, if discharged into natural environment, will destroy natural resources, pollute environment and may cause secondary pollution, so environmental protection measures shall be taken: to ensure, develop and save firefighting water supply; to use advanced firefighting equipment and well maintain the equipment; to use new extinguishing system and new extinguishing agents; to take more pollution prevention measures; to build a complete environmental protection system for firefighting industry.

Chapter 4. Laws, Policies and Regulations

The project covers PFOS production industries as well as its application industries like pesticides, electroplating and fire protection. The screening of project activities and its implementation need to meet the requirement of WB Safeguard Policies and Chinese laws, regulations.

4.1 WB safeguard policies

According to the project activities described in Chapter 2, the project triggers the WB Safeguard Policies: *OP4.01 Environmental Assessment*, *OP4.09 Pest Control* and *BP17.50 Information Disclosure*. Besides, the project also triggers WB safeguard policy *OP4.12 Involuntary Resettlement*. For details of its policy framework, see Social Management Policy Framework.

During the project implementation phase, *OP4.01 Environmental Assessment* will be fully applicable. Requirements such as: screening of loan-funded project activities; determination of project EIA; work scope relevant requirements of environmental impact analysis, requirements of information disclosure and public participation, and the requirements to prepare and implement environmental management plans, shall all meet *OP4.01 Environmental Assessment policy*.

As this project involves the use of pesticides and its alternatives, we will prepare an independent PMP in accordance with the requirement of *OP4.09 Pest Control*.

BP17.50 Information Disclosure will also be fully applicable in the project. So in this project, we shall carry out at least two rounds of work in information disclosure and public participation.

The project also applies to General Guidelines for Environment, Health and Safety, as well as Environment, Health and Safety Guidelines for Semiconductor and Other Electronics Manufacturing Industries, and Environment, Health and Safety Guidelines for Pesticide Manufacturing, Formulation and Packaging Industries.

4.2 Applicable laws & regulations

This project is part of China’s effort in performing the Stockholm Convention. The existing laws and regulations of China on POPs are applicable for PFOS production and application. In addition, China has introduced a series of policies, rules and standards to strengthen the management of PFOS-contained chemicals and pesticides.

4.2.1 Laws and regulations on management of POPs

From a macro level, the convention-controlled POPs' environmental pollution and damage control are applicable (regardless of its category, application, and management area)to the current general laws and regulations in China. Relevant laws and regulations, and applicable provisions are summarized below in Table 4-1..

Table 4-1 Laws and regulations on management of POPs

Management category	Name of laws and regulations (Effective date)	Contents applicable
Economical industry	Circular Economy Promotion Law of the People's Republic of China (January 2009)	This law contains pollution prevention in process of restructuring, production, use, recycling and disposal in relevant chemical industries (including PFOS industries). 1) Phase-out in production and use of toxic and hazardous substances; 2) Environmentally sound disposal of hazardous wastes; 3) Related incentives for phase-out of hazardous chemicals and environmentally friendly alternatives; 4) Enterprise and government responsibility of related to phase-out-product; 5) Relevant government regulatory responsibilities in circular economy law.
Environmental protection	Environmental Protection Law of the People's Republic of China(April 24, 2014)	This law contains legal requirements for PFOS-containing pollutants. Article 48: "In production, storage, transportation, sale, use and disposal of chemicals and materials containing radioactive substances, relevant provisions shall be complied with, so as to prevent environmental pollution." As a kind of Category I toxic pollutant, PFOS belongs to the control of toxic chemicals or pollutants.
	Law of PRC on Promotion of Cleaner Production(revised in 2012, effective since July 1, 2012)	To reduce pollution from its source, that is to say, to reduce or avoid generation and release of pollutants in production, services and using process. Article 19, Item 1: "Enterprises shall take following cleaner production measures in its technical reformation process: Use non-toxic/harmless materials or materials with low toxicity to replace toxic and hazardous materials; Article 27: For enterprises using/discharging toxic and hazardous materials in in its production, we will take compulsory cleaner production auditing measures.
	Environmental Impact Assessment Law of the People's Republic of China(September 1, 2016, Revised in July, 2016)	This law contains the pollution prevention in all kinds of economic activities involving toxic and hazardous chemicals (including PFOS). Article 2: " Analysis, forecast and assessment of possible environmental impact shall be taken in projects implementation and planning phase. Also, strategies and measures shall be taken to prevent or mitigate adverse environmental impacts. "This law also contains the pollution and risk management in PFOS-related reconstruction/expansion projects and PFOS-alternative-related reconstruction/expansion projects.
	Law on the Prevention and Control of Atmospheric Pollution of PRC(revised in 2015, effective from January 1, 2016)	This law contains the air emission control of toxic and harmful chemical pollutants (including PFOS). Hence, its is legally binding to air emission control of chemical pollutants containing PFOS. 1) Emission limits of air toxic pollutant, Article 36: "Enterprises discharging atmospheric dusts shall take dust-suppression measures. It shall strictly limit its emissions of toxic waste gases or dusts; Enterprises that need to emit waste gases shall undergo purification treatment. Emission limits shall not be exceeded. " Article 42: " Enterprises shall take sealing or other protective measures during transport, handling, storage of products which may emit poisonous and harmful gases/dusts." 2) Emergency prevention of atmospheric pollution, Article 20: "Enterprises emitting or leaking poisonous gas and radioactive substances due to accident or other emergent cases, shall take emergency measures, and inform nearby residents, and report to the local environmental protection authorities for investigation and treatment. "

Management category	Name of laws and regulations (Effective date)	Contents applicable
	Solid Waste Pollution Prevention Law of PRC (April 2004)	This law contains environmentally sound management, environmental security and emergency management in identification, collection, transferring and disposal of hazardous wastes containing PFOS. The law is legally binding to pollutant emissions of solid wastes containing PFOS.
	Water Pollution Prevention Law of PRC (June 2008)	This law contains water pollution control of toxic and harmful chemical pollutants containing PFOS. 1) It is legally binding to pollutant emissions of water wastes containing PFOS. 2) Discharge permit system for water pollution enterprises . Article 20 "Our country implements discharge permit system. Enterprises directly or indirectly discharging industrial wastewater and sewage should get Waste Discharge Permit; Operating units in charge of urban centralized sewage treatment facilities should also get Waste Discharge Permit. Specific measures and implementation procedures for this permit shall be made by the State Council. " 3) Phase-out system for backward technology and equipment causing serious water pollution. Article 41: "Our country shall implement phase-out system for backward technology and equipment causing serious water pollution. Comprehensive Economic Macro-Control Unit of the State Council, in conjunction with relevant units of the State Council, shall announce the list of technology (banned for use) causing heavy water pollution, as well as the list of equipment causing heavy water pollution which is banned for sale, import and use. Producers, sellers, importers or users should stop producing, selling, importing or using the equipment included in the equipment list within the stipulated period. Technology adopters should stop using the technology stated within the prescribed period. " 4) Limits on toxic pollutant emission. 5) Emergency measures for water pollution .
	Recycling Regulations of WEEE (August 2008)	Electrical and electronic products produced or imported shall meet the requirement of environmentally sound management for non-toxic, low-toxic or hazardous substances. Article 10: "Producers of electrical and electronic products, receivers or his/her agents of imported electrical and electronic products, as well as the electrical and electronic products itself, shall comply with relevant national laws on pollution control of electrical and electronic products. The products shall use a design plan conducive to resource utilization and harmless treatment, and adopt non-toxic/low-toxicity materials, and easy-for-recycle materials. The surface of electrical and electronic products or its manuals shall provide information such as content of hazardous substances and recycling tips in accordance with relevant provisions. "
	Planning Environmental Impact Assessment Ordinance(August 2009)	The law contains requirements on environmental pollution prevention and EIA of various development and construction planning involving PFOS production and emission. Article 30: " For planning and implementation area where its total pollutant discharge are above the index of total quantity control at national or local level, its EIA document and project document shall be suspended."
	Interim Procedures for Clean Production Audit (August	The law contains regulations, procedures and organizational management for mandatory cleaner production audit of enterprises involving PFOS production and emission.

Management category	Name of laws and regulations (Effective date)	Contents applicable
	2004)	
	Provisions on Cleaner Production Audit of Key Enterprises (December 2005)	This law contains provisions of cleaner production auditing of key enterprises involving PFOS production and emission and main list of hazardous substances in auditing.
	Rules on Environmental Information Disclosure of Key Enterprises and Institutions (January 1, 2015)	This law contains information disclosure and public scrutiny of toxic and harmful chemical pollutants containing PFOS.
	Notice on Release of Government Information Guide on Construction Project's Environmental Impact Assessment (Trial) (November 14, 2013)	"Construction unit shall disclose the information contained in construction project's environmental impact statement to the public before submitting them to environmental protection departments. Information involving state secrets, commercial secrets shall be deleted, and relevant explanatory report shall be made. Environmental protection department shall review construction unit's environmental impact statement, and disclose relevant information to the public in accordance with the law.
	Rules on Public Participation in Environmental Protection (MEP-Order No. 35, September 1, 2015)	To protect the rights of citizens, legal persons and other organizations in accessing environmental information and participating in environmental protection, we encourage them to involve in activities such as the development of environmental policies and regulations, implementation of administrative licenses, supervision of violations, and propaganda and education.
	Guiding Opinions on Promoting Public Participation in Environmental Protection (Office of Environmental Management [2014] No. 48)	The law contains the following information: we shall establish and improve the environmental litigation mechanism and clarify the scopes, contents, methods, channels and procedures of public participation. We shall strengthen the coordination and communication with the judicial authorities, and increase the legal guarantee in public participation of environmental protection. We shall take effective measures in protecting whistle-blowers. When the public appeals to People's Court for civil action of damages brought by environmental pollution, administrative department in charge of environmental protection shall provide support in evidence obtaining.
Occupational safety	*Production Safety Law of PRC(*November 2002)	This law contains risk prevention, spill prevention and emergency response during the production, storage and transport of PFOS-containing chemicals.
	Laws on Prevention and Cure of Occupational Diseases of PRC (May 2002)	This law contains control measures on occupational safety and health risks during the using of PFOS-containing chemicals.

4.2.2 Regulations and laws on pesticide management

Regulatory framework for pesticide management in China consists of three parts: national ordinances, departmental rules and technical standards. Based on *Regulations on the Control of Agricultural Chemicals*, China has established a set of management systems on pesticide safety related to pesticide registration, production, use, and import/export. The Ministry of Agriculture issued three department regulations: *Measures for the Implementation of the revision of Regulations on the Control of Agricultural Chemicals*; *Provisions on Pesticide Registration Information;* and *Management Approach for Pesticide Labels and Specifications.* Currently, there are more than 200 national/industry product standards, nearly 400 method standards, nearly 100 safety standards, and more than 10 poisoning treatment and environmental safety standards in China. For detailed description, see Annex 3 *Pest Management Plan*.

Table 4-2 Laws and regulations for pesticide management

Management area	**Name of laws and regulations(Effective date)**	**Contents applicable**
Pesticides-general laws (registration, production, use, import /export)	*Regulations on the Control of Agricultural Chemicals* (State Council Decree No. 326, November 29, 2001)	1) Our country implements Pesticide Registration System; 2) Pesticide production license system; 3) Pesticide import/export management system; 4) Supervision and management rules on pesticide industry, quality and waste disposal.
	Implementation Measures of Regulations on the Control of Agricultural Chemicals(Ministry of Agriculture, December 2007)	1) Article 7: In exceptional circumstances where pesticide need to be used, the pesticide producers shall apply for temporary registration of the raw material and formulation after field test; 2) Article 16: In case of urgent need, some unregistered/banned/restricted pesticides can be used within a certain period or temporarilly imported after the approval of Ministry of Agriculture.
Pesticide production	*Pesticide Production Management Approach* (NDRC, Order No. 23, effective since January 1, 2005)	According to the National Compliance Action Plan, pesticides containing PFOS belong to outdated, to-be-replaced products.
Pesticide application	*Banned Pesticides of PRC* (Ministry of Pesticide, 2004)	According to National Compliance Action Plan, pesticides containing PFOS belong to restricted products.
Import and export of specific pesticides (including Convention-controlled POPs)	*Environmental Regulations on First-Time Import of Chemicals and Import & Export of Toxic Chemicals* (former State Environmental Protection Administration, General Administration of Customs, Ministry of Foreign Trade and Economic Cooperation, 2007)	POPs-containing products belong to import-restricted toxic chemicals.

4.2.3 Regulations and laws on chemicals

PFOS belongs to newly-added controlled POPs in *Stockholm Convention*. *Regulation on the Control over Safety of Dangerous Chemicals* is our country's current regulation on

industrial chemicals management. Besides, there are a series of departmental rules on import and export of toxic chemicals and the registration system of new chemical substance, as outlined in Table 4-3.

Table 4-3 Regulations and laws on hazardous chemicals

Field	Name of laws and regulations(Effective date)	Contents applicable
Hazardous chemicals	*Regulations on the Control over Safety of Dangerous Chemicals*(State Council Decree No. 591, December 1, 2011)	This law contains safety supervision and management rules of dangerous chemicals during its production, storage and use.
	Measures for Implementation on Safety Permits of Enterprises in Production of Dangerous Chemicals	
	List of Hazardous Chemicals (2015)	PFOS is included in List of Hazardous Chemicals (2015) N - methyl-PFOS(31506-32-8) N- (2- hydroxyethyl) -N-methyl PFOS(24448-09-7) Potassium perfluorooctanesulfonate (1763-23-1) Perfluorooctane sulfonate (29081-56-9) Perfluorooctane sulfonic acid-ammonium sebacate (251099-16-8) Perfluorooctanesulfonates diethanol ammonium (70225-14-8) Perfluorooctane sulfonate potassium (2795-39-3) Lithium perfluorooctane sulfonate (29457-72-5) Heptadecafluorooctanesulfonic acid tetraethylammonium salt(56773-42-3) Perfluorooctanesulfonyl fluoride(307-35-7) N-Ethyl-N-(2-hydroxyethyl) perfluorooctane sulfonamide (1691-99-2) N- Ethyl perfluorooctane sulfonamide (4151-50-2)
	Supervision and Management Rules on Construction Projects of Hazardous Chemicals (State Administration of Work Safety, Order No. 45, April 1, 2012)	
New chemicals	*Environmental Management Measures on New Chemical Substances* (Ministry of Environmental Protection, Order No. 7, October 15, 2010)	The law clarifies the national fundamental policy for new chemicals, namely: Our country implements registration and tracking control system for new chemicals as a form of national risk classification management. According to the identification/classification standards of hazardous chemicals, new chemicals are divided into general-type new chemicals and hazardous-type new chemicals. Hazardous-type new chemical is a kind of substance which brings persistent, bio-accumulative, ecological, and human-health hazards, belonging to the type which needs key environmental management.
Export/import of hazardous chemicals	*Environmental Regulations on First-Time Import/Export of Hazardous Chemicals* (effective from May 1,	Environmental regulations on first-time import/export of hazardous chemicals shall follow the rules in London Guidelines for the Exchange of Information on Chemicals in International Trade (Revised version of 1989).

Field	Name of laws and regulations(Effective date)	Contents applicable
	1994)	
	Notice on Strengthening the Administration of Registration for Export & Import of Hazardous Chemicals (Office of Environmental Management [2009] No. 113)	This law contains information about comprehensive prevention and control measures for environmental risks of toxic chemicals in its production, use, storage, and disposal process. Since January 1, 2010, all import and export enterprises and relevant enterprises involving items included in the List of Banned Hazardous Chemicals in Export/Import shall implement the rules stated in Registration and Approval Process of Environmental Management for Import and Export of Hazardous Chemicals.

4.2.4 Technical guidelines for contaminated sites

1) *Technical Guidelines for Environmental Site Investigation* (HJ25.1-2014). This guideline specifies the principles, contents, procedures and technical requirements in environmental investigation of soil and groundwater in site. The guideline is suitable for site environmental investigation. It will provide basic data and information required for environmental management of contaminated sites. This guideline does not apply to the investigation of radioactive site.
2) *Technical Guidelines for Environmental Site Monitoring* (HJ25.1-2014). This guideline specifies the principles, contents, procedures and technical requirements in environmental monitoring. This guideline is suitable for site environmental monitoring in works such as environmental site investigation, risk assessment, environmental supervision of soil remediation project, works acceptance, and retrospective assessment. This guideline does not apply to the investigation of radioactive site.
3) *Technical Guidelines for Risk Assessment of Contaminated Sites* (HJ25.3-2014). This guideline specifies the principles, contents, procedures and technical requirements for human health risk assessment of contaminated sites. It is suitable for human health risk assessment of contaminated sites as well as the confirmation of controlling values for contaminated soil and groundwater risks. This guideline does not apply to risk assessment of sites containing lead, radioactive substances, pathogenic biological contamination, or agricultural land pollution.
4) *Technical Guidelines for Soil Remediation of Contaminated Sites* (HJ25.4-2014). This guideline specifies the principles, contents, procedures and technical requirements in preparation of technical programs for soil remediation at contaminated sites. It is suitable for the preparation of technical programs for soil remediation in contaminated sites. Guidelines for groundwater remediation will be published separately. This guideline does not apply to soil remediation of sites containing radioactive contamination or pathogenic organisms.
5) *Guide to Environmental Site Assessment and Remediation* (Trial) (Ministry of Environmental Protection, No. 78, 2014). This guideline specifies the work processes, basic requirements and technical methods in work of environmental site assessment and remediation. It provides technical guidance for site environmental investigation, risk assessment, management and remediation, environmental supervision, remediation acceptance, and post management. It also provides technical support for the management and supervision of competent authorities, thus reducing environmental risks of contaminated sites.

4.2.5 Other relevant technical guides

Other relevant technical guidelines applicable for this project include: laws and regulations related to cleaner production audit, evaluation index system for cleaner production audit, and relevant technical standards. It also include evaluation index system for cleaner production in electroplating industry, standard conditions for electroplating industry, and respond to environmental emergencies.

1) *Index System for Cleaner Production Evaluation of Electroplating Industries* (NDRC, No. 25, 2015);
2) *Standard Conditions for Electroplating Industry* (MIIT, No. 64, 2015)
3) *Management Measures in Environmental Emergency* (MEP, No. 34)

4.3 Gap analysis

In addition to the World Bank's Safeguard Policies: OP4.01 *Environmental Assessment* and OP4.09 *Pest Management*, this project shall also conform to the *EHS Guideline for Semiconductor and Other Electronic Products Manufacturing Industry*.

In the following, the IFC's EHS guidelines are compared with Chinese laws and regulations. For this project, the following national and industrial standards shall apply: the *Integrated Emission Standard of Air Pollutants (GB16297-1996)*, the *Integrated Wastewater Discharge Standard (GB8978-2012)*.

China's pollutant discharge standards are compared with the two IFC's EHS guidelines.

Table 4-4 Comparison of standards and regulations at home and abroad

China	World Bank
***Integrated Emission Standard of Air Pollutants* (GB16297-1996)** Emission standard of fluoride-contained gas: 20μg/m³, that is, 0.02mg/L (stricter than the *EHS Guideline for Semiconductor and Other Electronic Products Manufacturing Industry*) ***Emission Standard of Pollutants for Electroplating* (GB21900-2008)** For existing and new enterprises: discharge standard of fluoride-contained wastewater is 10mg/L (main discharge outlet) (Higher than the discharge standard of the *EHS Guideline for Semiconductor and Other Electronic Products Manufacturing Industry*) ***Integrated Wastewater Discharge Standard* (GB8978-2012)** Discharge standard of fluoride-contained wastewater: 1. Yellow phosphorus industry: 10mg/L (grade-I), 20mg/L (grade-II), 20mg/L (grade-III); 2. Low fluorine-content areas (<0.5 mg/L): 10 mg/L (grade-I), 20 mg/L (grade-II), 30 mg/L (grade-III). Other pollutant sources: 10 mg/L (grade-I), 10 mg/L (grade-II), 20 mg/L (grade-III).	***EHS Guideline for Semiconductor and Other Electronic Products Manufacturing Industry*** 1. To reduce PFOS discharge by reducing the unnecessary use of PFOS-contained substances in semiconductor production, e.g. the use of alternatives products (in substitution of some complex agents), the controlled disposal of wastes if no alternatives product is available, for example, the short-wave technology; 2. Emission standard of hydrogen fluoride gas (at standard state): 5mg/m³' 3. Discharge standard of fluoride-contained effluent: 5mg/L.

China	World Bank
(Looser than the *EHS Guideline for Semiconductor and Other Electronic Products Manufacturing Industry*)	

By comparing the quantified indicators in the above tables, we conclude that: as for $COD_{Cr,}$ the common indirect discharge standard of China is the same with EHS standard, but the direct discharge standard is far stricter than EHS standard; as for suspended solids (SS), the special discharge limits of China are close to EHS standard, but the common discharge limits of China are far higher than EHS standard; as for total phosphorous, the discharge standard (0.5mg/L) of China is far stricter than EHS standard (2mg/L); as for total ammonia, the discharge standard of China is close to EHS standard; as for total arsenic, the discharge standard of China is the same with EHS standard.

In conclusion, the discharge standards of China generally are stricter than or close to the standard of EHS Guideline, that is to say, the enterprises conforming to Chinese standards will also meet the World Bank's requirements.

Chapter 5. Environmental screening and management procedures

PMO at all levels shall screen demonstration enterprises for environmental management in accordance with the following procedures. The demonstration enterprises should carry out preparatory environmental work. Meanwhile, they shall conduct information disclosure and public participation as per the requirement of WB and China. Besides, they shall accept the supervision and inspection of PMO at all levels and WB.

5.1 Environmental screening of project components

NPMO/FECO and LPMO shall screen the alternative projects from an environmental perspective. Its basic screening criterion is as follows:

Criteria 1: The project belongs to the priority sectors (such as PFOS production, electroplating, pesticides and fire protection)in using and producing of PFOS, and its production process is of typical type.

Criteria 2: Enterprises have valid environmental impact assessment report and have obtained approval from environmental protection authorities with administrative privileges.

Criteria 3: Enterprise's sewage discharge meets the standards, and there is no major environmental pollution incident.

5.2 Preparation of project component

In accordance with the relevant laws, regulations, standards and policies of PRC and WB, participating enterprises shall carry out relevant preparatory work. Its specific requirements are as follows. According to the characteristics of project activities stated in chapter two, the implementation units are divided into two types: enterprise-type and non-enterprise type, Enterprise-type project activities include three scenarios: industry conversion, shutting down and technological transformation; Non-enterprise-type project activities involve agricultural and fire protection industries.

5.2.1 Enterprises in industry conversion

Enterprises in industry conversion shall invite qualified EA Consultant to prepare EIA (in predicting the environmental impact after industry conversion) and sent it to local EPB, in accordance with national regulations (mainly EIA Law) and WB policy. Based on EIA, the enterprise shall prepare Mitigation/Action Plan (i.e., Environmental Management Plan-EMP). Specific requirements of EMP are seen in Annex 1.

If the enterprise just plans or proposes to change the line of production, environmental audit (see 5.2.2) shall be carried out to check the existing environmental protection work of the enterprise and find problems and defects, and a series of improvement measures shall be established to improve the enterprise' environmental management and guarantee the effects of the demonstrative activities.

5.2.2 Enterprises in technological transformation

Enterprises in technological transformation shall carry out environmental audit (also known as "ecology check" in China) to check the enterprise's fulfillment-of-duty status in environment protection, on the basis of national rules and WB policies. On the basis of an environmental audit, the enterprises shall propose a series of measures for

process/management optimization, and form an EMP, in the aim of cleaner production. For specific requirements, see Annex 2.

If, in accordance with national requirements, EIA is needed for technological transformation, then enterprises shall be responsible for conducting EIA and get its approval. EIA's main contents, conclusions as well as recommendations shall be included in EMP.

Environmental audit aims to define the nature and severity of environmental problems of an existing facility. It also proposes and demonstrates mitigating measures estimates the cost of these measures and gives advices for the implementation of the measures. The environmental audit may be only part of the EIA report, or an environmental audit document is attached to the EIA report. Refer to Annex A of OP4.01 *Environmental Assessment*.

Environmental audit is carried out to check whether the operation of a facility conforms to relevant standards, policies and regulations. Once any discrepancy is found, the EMP shall be prepared and mitigating measures and monitoring arrangement shall be proposed in the EMP.

5.2.3 Enterprises to be shut down

Enterprises to be shut down shall conduct environmental site investigation and assessment (environmental site monitoring, if necessary) in accordance with national rules and WB policies. They shall analyze the site's pollution status and potential long-term impact. Based on the site's possible uses, enterprises shall propose corresponding site remediation measures. For specific requirements, see *Technical Guidelines for Environmental Site Investigation* (HJ25.1-2014), *Technical Guidelines for Environmental Site Monitoring* (HJ25.1-2014), *Guidelines for Risk Assessment of Contaminated Sites* (HJ25.3-2014), and *Technical Guidelines for Soil Remediation of Contaminated Sites* (HJ25.4-2014). Enterprises shall prepare site investigation report, which should include the EMP (key impacts, mitigation measures, and monitoring plans). See Annex 3 for details.

5.2.4 Non-enterprises level demonstration activities

The activities involving no enterprise mainly include applications of PFOS-based products in pesticides and fire protection.

The demonstrative areas/users of alternatives pesticides shall disclose to the public the EMF and PMP (see Annex 4), attend the initial trainings arranged by the PMOs of all levels, provide a written letter of commitment on implementation of the PMP, and clarify the institutional settings and responsibility division.

Most of users of PFOS-contained extinguishing agents are fire departments. The selected fire departments (e.g. training base) shall attend the initial trainings and prepare a detailed EMP based on the format of EMP in annex 5. The EMP shall include detailed measures to mitigate the adverse environmental impacts from use and disposal of extinguishing agents.

5.3 Information disclosure and public participation

In order to meet the requirements of national and WB policies, information disclosure and public participation shall be needed for environmental documents prepared.

Enterprises should carry out sufficient information disclosure. The above mentioned environmental documents should be publicized for at least 14 days. After that, enterprises shall carry out public participation so as to solicit public opinions. PIUs should provide understandable public materials through an easily accessible way to affected groups (places such as PMO office or public library, local traditional media and networks, etc.). Public materials shall provide ways and means for feedback in a clear way.

Demonstration enterprises are responsible for carrying out public participation so as to solicit public opinions. Demonstration enterprises or its authorized technical units shall carry out public participation on the site. Public consultation should be carried out in an effective manner after full information disclosure (ie, for at least two weeks). Approaches include household and individual interviewing, discussion meeting and questionnaire survey. The survey shall focus on affected masses rather than local government officials.

5.4 Review and approval

Firstly, the participating enterprises shall submit EIA report to local environmental protection department (bureau) for approval in accordance with relevant provisions of national laws and regulations as well as management policies

Meanwhile, the participating enterprises/units shall submit above-mentioned environmental materials to LPMO or NPMO in accordance with the requirements of WB.

1) EIA Report/Environmental Audit Report/Site Assessment Report. All reports are inclusive of EMP, which can be listed in a chapter of a report or as a separate edition;

2) EIA report form for domestic approval/ EIA report and the copy of the approval;

3) Review-related additional materials considered as necessary by NPMO.(including Letter of Commitment for PFOS-related pesticide industries).

After receiving the documents, PMO at all levels shall review the above documents and give reviewer's comments and conclusions (approval, re-review after modification, or rejection). WB shall review only the first sub-project of each industry. Review of the rest will depend on the need. FECO will submit aforesaid English-version environment documents to WB for review, and WB will provide technical support.

5.5 Implementation and supervision

Contents in foregoing environmental documents prepared (especially the EMP), need to be implemented in the project implementation period, so as to effectively mitigate and control negative impacts and environmental risks.

As leading sector in charge of PFOS compliance, MEP is responsible for the overall coordination of China in POPs compliance. Through its FECO, MEP is responsible for leading the implementation of this project.

According to project characteristics, its environmental protection measures fall not only under the regulation of provincial environmental protection department (bureau), but also the supervision of relevant departments of WB. The main responsibilities of relevant environmental administrative organizations are as follows:

With the help of environmental experts and local EPA, FECO will be responsible for the supervision of project component's EMP implementation; and be responsible to regularly

report to the WB on the implementation of EMP.

As the national PMO, the FECO is the contact agency of the GEF Secretary/WB. The FECO is in charge of the coordinator and the project management. The LPMO is in charge of the supervision of the mitigation measures are implemented. The local EPB will supervision and the activities are in meet the relevant Laws in China and the Bank's Policies.

There are two implementation approaches: First, FECO carries out activities in demonstration enterprises or executive units through PPMU. Second, FECO directly carries out activities in corresponding demonstration enterprises or executive units. Whatever the implementation approach is, the subject of EMP shall be enterprises or PIUs (such as pesticides and fire protection units); Enterprises or executive units are obliged to accept irregularly scheduled checks and supervisions of PMO at all levels, and to submit them with monitoring data and documents required by EMP. Project agreements signed by PMO and PIU shall clarify above responsibilities and obligations.

PMO at all levels shall supervise the implementation of EMP by demonstration enterprises to check whether they meet the relevant requirements of administrative department in charge of environmental protection and WB Safeguard Policies.

During the project implementation period, FECO shall irregularly inspect the project site of demonstration enterprises at least once a year. If FECO finds that enterprises fail to properly carry out EMF, it will increase its frequency of on-site supervision, until the situation is improved.

LPMO should carry out day-to-day supervision and management of demonstration enterprises under its jurisdiction. Demonstration enterprises should accept the guidance and supervision of NPMO and submit project-related information to NPMO for its on-site inspection.

5.6 Reporting system and requirements

In order to carry out a preferable environmental management work, each PMO shall document their job in a timely manner and make summary. Every year, each PMO shall submit a semi-annual progress report to NPMO. The report shall include:

1) Implementation of EMP in project component during the reporting period.
2) Implementation of PMP(if involved);
3) Review results and comments to documents submitted by demonstration enterprises:
4) Environmental training undertaken during the reporting period;
5) Environmental quantitative monitoring data and results of its analysis during the reporting period;
6) The next reporting period (next six-month)'s work priorities and corrective measures in environmental protection.

NPMO shall prepare a semiannual EMP Implementation Report and submit it to WB in accordance with above-mentioned requirements, or include a book chapter about the implementation of EMP in its project's semi-annual progress report. The book chapter shall include the following contents stated in 1) to 6).

To carry out a preferable environmental management, PMO at all levels may invite consulting units to carry out independent external monitoring for the implementation of EMP.

Chapter 6. Institutional capacity evaluation/building

6.1 Institutional capacity evaluation

6.1.1 NPMO

The FECO, directly under the MEP, is the national PMO. It is founded in 1989, and on May 1997 and January 2016, its functions were optimized. Its responsibilities include:

1) Responsible for the management of foreign loan projects on technical assistance;
2) Management of environmental protection funds for international financial organizations, bilateral aid funds, and other external environmental cooperation issues.
3) Organization of research on environmental conventions; participation in negotiations related to environmental conventions; implementation of related activities with specific technical, transactional requirements.

As the NPMO, FECO is quite familiar with management requirements for GEF-funded project, as well as policies in management, security, finance, and procurement as stated by WB and other international institutions. As PMO, the FECO has also successfully prepared Environmental Policy Framework for Emission Reduction Project of HCFCs Industries, GEF-funded Contaminated Site Management Project-China, Capacity building project in Implementation of Minamata Convention-China, and more. Besides, the FECO has successfully prepared the Safeguard Policies on projects granted by international financial institutions.

6.1.2 LPMO

According to requirement of project activities, 2 provincial-level PMOs will be arranged at Hubei and Guangdong provincial environmental protection bureau for the manufacturing industry and galvanization industry.

The provincial PMO in Hubei is arranged in Hubei Solid Waste and Chemical Pollution Prevention Center (hereinafter referred to as Hubei Provincial Solid Waste Treatment Center), which is an organization directly under Hubei Provincial Environmental Protection Bureau. The main responsibilities of Hubei Provincial Solid Waste Treatment Center include:

1) Carrying out research on policies, regulations and technologies related to solid waste control and environmental management of chemicals. Providing technical supports for relevant analysis, testing, identification, and information analysis, environmental management of contaminated sites, and prevention and control of heavy metals pollution.
2) Undertaking propaganda and education work and international cooperation work related to solid waste control and chemical pollution prevention;
3) Undertaking technical review on the number of dismantled WEEE and application of subsidies.
4) Undertaking the work related to the implementation of international environmental conventions on management of chemicals and solid waste control in Hubei

province, as well as the management of Information Systems on Hazardous Waste Regulation in Hubei province.

In recent years, the Hubei Provincial Solid Waste Treatment Center has undertaken many projects, including GEF-funded Project on POPs Reduction of Electrical and Electronic Products during its Life-cycle. To better meet the requirements, Hubei Provincial Solid Waste Treatment Center has brought in PhDs on relevant fields in strengthening the construction of talents team.

Guangdong provincial PMO was established at the Publicity, Education, Exchange and Cooperation Office of the Department of Environmental Protection (hereinafter referred to as "the PEECO"). Its duties include:

(1) To develop environmental protection publicity and education plan, formulate environmental protection regulations and manage the implementation of the same.

(2) To manage public participation trainings to promote participation of social organizations in environmental protection; to grant commendations and awards in environmental protection.

(3) To review and release official news of the Department of Environmental Protection, including the release of grave news in environmental protection, arrangement of interviews and reports, review of news manuscripts of major events, and collection and analysis of public opinions and internet environmental information.

(4) To manage international exchange and cooperation in environmental protection and external relations of the institutions directly under the Department of Environmental Protection: including formulation and implementation of international exchange and cooperation plan in environmental protection; review of relevant documents and liaison with foreign organizations; getting in touch with consulates of foreign countries in Guangzhou; review and management of international environmental protection conferences held in China; review of the guests invited by us to attend environmental protection cooperation activities in Guangdong; receipt of foreign delegations and sending of delegations to foreign countries.

(5) To assist in the implementation of international conventions on environmental protection, manage the execution of international cooperation programs, provide support and guidance to the institutions directly under the Department of Environmental Protection in the execution of international cooperation programs.

With rich experience in capacity building and demonstration in lots of international programs, such as the Sino-Norway POPs Convention Implementation Capacity Building Program and the DDT Substitution Program in Production of Anti-fouling Paint in China, the Publicity, Education, Exchange and Cooperation Office is familiar with international convention implementation programs and their requirements.

6.2 Institutional capacity building

In the preparation stage, the demonstration provinces will actively involve in the project design process. Invited by FECO, demonstration provinces will participate in kick-off meeting, training activities, and introduce World Bank experts at the project site.

PMU at all levels, FECO, provincial PMO, PIUs shall designate staff to manage the project's environmental social risks and ensure the implementation of EMP. In addition, the PMU may invite qualified environmental consultants or institutions in China to assist its work in environmental risk assessment and management.

PMU shall invite qualified environmental consultants and/or institutions to provide relevant environmental/social security training to subproject-management-units or relevant units. Subproject-management-units shall prepare and implement EMP with the assistance of consultants. The technical training shall include: 1) Project-related environmental laws/regulations and legal regulations in social aspect; 2) environmental/social impact assessment procedures; 3) problems which may arise in project preparation and implementation;4) WB-related safeguard policies.

Chapter 7. Information disclosure and public participation

7.1 Information disclosure

As a category-A project, the first draft of the policy framework has been publicized on the website of NPMO on March 23 in accordance with requirements of OP4.01 and relevant national policies.(Website: Http://www.mepfeco.org.cn/dtxx/tzgg/201603/t20160324_24929.html). Publicity period: March 23, 2016 - April 6, 2016; meanwhile, the policy framework document has been publicized in demonstration enterprise-Hubei Hengxin Chemical Co., Ltd.

Meanwhile, the policy framework document has been publicized in demonstration enterprise-Hubei Hengxin Chemical Co., Ltd. In the next stage, we will be carry out public participation work in demonstration enterprises and related institutions.

To further solicit opinions from relevant stakeholders, the revised *Environmental Management Framework* has been disclosed to the following organizations in the fields of manufacturing and application from June to August:

(1) National Project Management Office, from June 27th, 2016 to July 11th, 2016, on the website of National Project Management Office (http://www.mepfeco.org.cn/dtxx/tzgg/201606/t20160627_67864.html).

(2) Provincial Project Management Office, from July 4th, 2016 to July 18th, 2016, on the website of Hubei Provincial Department of Environmental Protection (http://report.hbepb.gov.cn:8080/pub/root8/tjgzs/gtfwgl/201607/t20160704_96104.html), Figure 7-1.

Meanwhile, on July 1st, 2016, it was also disclosed on the website of Hubei Academy of Environmental Sciences. (http://www.hbaes.com/newsView.do;jsessionid=4E51050C2E10EE8AC1D43B5EC7E86063?infoId=2010), Figure 7-2.

(3) Manufacturing Industry: from August 4th, 2016 to August 18th, 2016, on the website of the Yingcheng Environmental Protection Bureau (http://www.hbycepb.gov.cn/html/2016/0803/892.html). The *GEF-funded Project for Phase-out of PFOS-related Industries in China - Environmental Auditing Report for Hubei Hengxin Chemical Co., Ltd* was also disclosed on website of the Yingcheng Environmental Protection Bureau (http://www.hbycepb.gov.cn/html/2016/0803/891.html).

(4) Pesticide Application Industry: from June 27th, 2016 to July 11th, 2016, on the websites of the NATESC and the Plant Protection Stations of five provinces, i.e. Fujian Province, Guangdong Province, Guangxi Province, Hainan Province and Yunnan Province：

1) The NATESC: (http://www.mt0033.com_www.natesc.gov.cn/Html/2016_07_01/2_1878_2016_07_01_429710.html)

2) Fujian Plant Protection Station (Fujian Agricultural Information Network, http://www.fjagri.gov.cn/html/hypd/zwbh/zwjy/2016/07/04/161347.html)

3) Guangdong Plant Protection Station (Guangdong Agricultural Information Network, http://www.gdagri.gov.cn/ywzx/zbzjzz/201607/t20160704_553553.html)

4) Guangxi Plant Protection Station (Guangxi Plant Protection Network, http://www.gxzb.com/html/2016-07/20162016070117002489 44.html）

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5) Hainan Plant Protection Network (http://www.hizb.cn/a/zhibaogonggao/2016/0711/64.html)

6) Yunnan Plant Protection Station (http://www.ynzbzj.com/Item/163.aspx).

(5) Electroplating Application: on the websites of Electroplating Division of China Surface Association (EDCSEA) (China's Surface Treatment Network, http://www.zgbmcl.com/news/12087.html), China Surface Engineering Association (CSEA)(http://www.csea1991.org/Html/1041/1064/612.html) and China Electroplating Association (CEA)(http://www.zgdd.org/newsitem/277419763).

7.2 Public participation

In the preparation stage, FECO has held many public participation activities and discussion meetings on environmental safeguard policies of WB and relevant national policies. In designing project activities, FECO has collected views of the relevant units. At present, directly affected groups are will-informed of the National Compliance Action Plan. The production industry will focus on the compensation policy on stop-production and converting, and PFOS application industry will pay more attention to the study of alternative technologies.

Date	Participants	Contents in discussion
First draft of Policy Framework: The first round of public participation		
2015.6.26	Discussion meetings, Officials & experts from WB and FECO, competent authorities and industry associations from the priority sectors including China Association of Fluorine and Silicone Industry (manufacturing industry), China Electroplating Association, National Agro-Tech Extension and Service Center and China Certification Center for Fire Products, representatives from manufacturing enterprises (level-I and level-II,)	• Compliance requirements on PFOS in China(related policies & notices) • Arrangement of related activities. • The WB's environmental & social safeguard policies and relevant requirements
2016.1.14	Discussion meetings/telephone interviews, FECO, industry experts, primary-level representatives from manufacturing enterprises	• Analysis on national policy • Arrangement of related activities (manufacturing industry) and project progress • The WB's environmental & social safeguard policies
2016.3.14	Discussion meetings/telephone interviews, FECO, industry experts, and representatives from trade associations, electroplating enterprises and industrial park of electroplating	• Analysis on national policy • Arrangement of related activities (electroplating industry) and project progress • The WB's environmental & social safeguard policies
2015.07-2016.03	Discussion meetings/telephone interviews, FECO, industry experts, electroplating & fluorosilicone associations (manufacturing industry), agricultural technology promotion center, assessment center of fire products, representatives from relevant enterprises(no less than 10 sessions)	• Arrangement of related activities and project progress • The WB's safeguard policies

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Date	Participants	Contents in discussion
Revised Policy Framework: The second round of public participation		
2016.7.7	Discussion meetings/telephone interviews, representatives from the Chemours Company and FECO.	•Activities of fire protection sector; •Demonstration enterprises within the fire protection sector
July, 2016	FECO, experts from Tsinghua University (Professor Huang Jun), PMO of Guangdong Province, Guangdong electroplating industrial park, representatives from electroplating enterprises (all Guangdong Electroplating Association members are informed of this event and some representatives participated). Figure 7-3.	•Requirements of national policy •Activities and budgets of electroplating industry • The WB's safeguard policies
July, 2016	Telephone interviews. After the second round of public announcement is made, PMO of Hubei Province informed all enterprises (including 8 manufacturing enterprises) and solicits opinions and consultation through telephone interviews.	•No comments were made by any enterprise.
July, 2016	Written consultation/ telephone interviews. After the second round of public announcement is made, PMO of FECO make contacts with other domestic manufacturing enterprises (including 1 demonstration enterprise) through emails and telephone calls.	•No comments were made by any enterprise.
July, 2016	Telephone interview. After the second round of public announcement is made, PMO of Guangdong Province contacted in telephone with interested electroplating parks (3 interested parks) and enterprises for opinions.	•Parks and enterprises did not expressed any comments.
July, 2016	Written consultation/ telephone interviews. After the second round of public announcement is made, the National Agro-Tech Extension and Service Center of Ministry of Agriculture contacted in telephone and emails with provincial plant protection and quarantine agencies in Guangdong, Fujian, Guangxi, Hainan and Yunnan provinces to check whether any feedback has been received.	•Supports for procedures and requirements specified by the Policy Framework of this project have been made.
***Environmental Audit Report*: Hubei Hengxin**		
August 10, 2016	Hubei Hengxin Chemical Co., Ltd. held a discussion meeting at the company's conference room. 35 persons attended the meeting, including Hengxin's employees and surrounding residents affected by the project. Questionnaires were distributed in the meeting; refer to Figure 7-4.	In the meeting, 100 questionnaires were distributed and 86 questionnaires were returned. Hengxin introduced main types of PFOS and their impact on health and environment. The affected persons support the PFOS phase-out of Hengxin and they were very concerned about the phase-out technology.

Figure 7-1 EMF disclosed on Hubei EPB

Figure 7-1 EMF disclosed on HAES

Figure 7-3 July 2016，Public participation forum of electroplating industry in Guangdong Province

Figure 7-4 August 10, 2016, Hubei Heng New Chemical Co., Ltd. environmental verification report of the public participation in the Forum

Annex 1: TOR of EA & ESMP

In order to meet the performance targets to phase out PFOS, FECO and WB have developed the "GEF- Reduction and phase-out of PFOS in priority sectors in China". The project belongs to the area of chemicals management. It is aimed at helping China fulfill its mandatory obligation in phasing out of PFOS and its salts, as is stated in Stockholm Convention on POPs.

The ESMP shall be prepared and implemented in accordance with national laws and regulations, technical standards, specifications and related policies, WB's safeguard policies OP4.01, as well as the procedures stated in Chapter 5.ESMP shall propose detailed mitigation measures, organization settings, monitoring arrangements, expense budget, and reporting/complaining mechanisms for tackling the adverse impacts in project implementation period. ESMP includes the following aspects:

Task 1 Project Description

The project description will be include but not limit: project components, size, location, technical specifications, auxiliary facilities, public facilities, construction methods, materials & progress, and investments etc.

Task 2 Environmental and Social Baseline investigation

Collect current environmental and social information directly related to this project, including data and drawings provided in technical documents such as project construction plan, feasibility study report and preliminary design, and also including the EIA report, the acceptance report of the completed project, the environmental protection examination documents (if any), the cleaner production audit report (if any) and etc.

2.1 The focus in investigation on current status of regional natural & social environment:

1) **Natural environment.** Including geology, geomorphology, meteorology, climate, hydrology, hydrology, and distribution of natural heritages (if involved) and nature reserves (if involved).

2) **Social environment.** Including regional economy development, location & population of residential areas, scale of enterprises and institutions, direction and distance against the converting project of PFOS production enterprises, distribution of cultural heritage sites (if involved) , etc.

3) **Regional pollutant sources.** Especially areas where its river section, atmospheric environment and environment carrying capacity are substandard.

4) **Environmental functional zoning and ecological function zoning, etc..**

2.2 The focus in investigation on the status of enterprises:

1) **Basic situation of enterprises.** Including components of production shops (or devices) & auxiliary facilities; production scale, production methods and product categories of production shops (or devices); product categories and production and varieties and consumption of materials and auxiliaries; consumption of public works (e.g. water, electricity, steam) in auxiliary facilities.

2) Utilization of water resources: including water supply and drainage of production shops (or devices) and auxiliary facilities and water balance diagram. The aim is to find out the environmental problems and pollution risks by calculating water recycling rate.

Task 3: EIA

To identify, analyze and predict the potential environmental and social impact of the project from 3 stages: design, construction and operation. Evaluation keys include major impact and special considerations of engineering site.

(1) Design period

The purpose is to reduce the negative impact on the environment from its source, and to make analysis on alternative plans, etc..

(2) Construction period

For enterprises undertaking transformation, it shall focus on the demolition process of plant equipment, and the recycling and disposal process of waste.

(3) Operation period

For enterprise undertaking transformation, it shall focus on the environmental impact assessment of various factors. For POPs, THMs and specific pollutants produced in production and pollution control, the enterprise can carry out monitoring or analogy investigation to find out their impact on environmental sensitive spots. At the same time, the analysis shall focus on the adverse effects of the construction project, so as to find out the environmental sensitive spots in site selection.

1) Atmosphere

a) During environmental impact analysis of ambient air sensitive spots, we should consider the maximum total impact brought by both the background value and its predictive value of a certain area.

b) The total value will provide a basis for analyzing the environmental quality after the project is completed. If there are other construction projects within the assessment domain, their impact on the quality of the environment shall also be taken into consideration.

c) Make an analysis of maximum environmental impact on ambient air sensitive spots and the assessment domain under typical-hour weather conditions. The content for analysis includes the level, position, probability and maximum duration when the concentration surpasses the given standard.

d) Make an analysis of maximum environmental impact on ambient air sensitive spots and the assessment domain under typical-day weather conditions. Specific requirements are the same as stated above.

e) Make an analysis of maximum environmental impact on ambient air sensitive spots and the assessment domain under long-term weather conditions.

f) Make an analysis of the environmental impact brought by different emission plans. Make an evaluation of the emission plan based on the analysis of project location, plant layout, pollution source, and pollution control.

2) Water

Generally, we use standard index evaluating method to make an evaluation of water quality factors. If the standard index of water quality parameters >1, it means the water quality parameters exceed the prescribed water quality standard.

3) Acoustic noise

a) It includes noise prediction results and related ambient noise standards, the degrees of impact at various stages of operating period, the above-normal range and status (mainly sensitive receptors).
b) Make an analysis of the distribution of PAPs(focusing on above-normal areas)
c) Make an analysis of the distribution of major noise source and its causes.
d) Make an analysis of the rationality of site selection, equipment layout & model (or project layout), as well as the applicability and effectiveness of current noise control measures.

4) Environmental risk assessment

This shall be carried out based on the identification of major hazards and investigation of environmental accidents brought by similar equipment.

5) Expansion and reconstruction project

The following principles of impact assessment shall be followed:

a) To find out the existing environmental issues and pollution risks, so as to bring up solutions which are technically sound and economically feasible based on the principles for technical modification project.
b) To give the name, technology/method, investment cost, operation cost and expected effect of the measures for technical modification project.

Check and ratify the amount of pollutants reduced by measures for technical modification project.

Task 4: Information disclosure & public consultation

According to WB policy, information disclosure and public consultation should be conducted: 1) after the completion of the EIA outline (first round); 2) after draft for EIA report is completed (second round).Public consultation should be carried out in an effective manner after full information disclosure. Approaches include household and individual interview, discussion meeting and questionnaire. The survey shall focus on affected masses rather than local government officials.

At first-round public consultation, project information and potential environmental issues should be disclosed to PAPs. In second round, all EIA reports should be posted in public in full text. Meanwhile, local media (newspapers, radio, television, or website) shall notify the public about the time and place of information disclosure and the feedback channel. The information disclosure shall be long enough for the public to fully understand the project and raise substantive opinions. The EIA report must record the date, place, content, and method of information disclosure and public consultation, as well as the number of participants, occupation, PAPs' concerns, opinions and suggestion. Besides, the EIA report must record how PAPs' concerns, opinions and suggestion are treated.

For Category-A project, the PIU need to carry out at least 2 rounds of Progress Report

Meeting participated by consulting units.

Task 5: Preparation of ESMP

1. Institutional settings in environmental management

The organizational structure in environmental management shall be clarified, listing the roles, responsibilities and staffing of PMO, PIU (legal person), contractors, supervision engineers, operators and environmental monitoring (see Table 1).

2. Mitigation measures

We shall propose concrete and operable mitigation measures and explain its implementation and supervision plan as well as its cost budget (see Table 2) in accordance with national regulations, standards, management practices, and past experiences in similar projects. We shall also refer to the International Finance Corporation's "General Environment, Health and Safety Guidelines" (referred to as the "EHS Guidelines").

3. Monitoring plan

It refers to specific environmental monitoring plan during the construction/operation period, including: Monitoring objects (air, water, waste, noise, etc.), monitoring indicators/methods/location/time /frequency/costs.

4. Capacity building and training programs

It aims to familiarize project stakeholders with EMP, thus enhancing its implementation capacity. The training program shall include: Training contents, time, person-times, and arrangement and cost estimation for PMO, PIU, contractors/workers, supervision engineers, operating units and staff.

5. Monitoring and reporting system

It refers to periodic reporting arrangements for implementation of EMP, and concrete proposals for the project reports. Take fire-protection application industry as an example.

Table 1 List of environmental management system

Phases	Project stakeholders	Environmental duties	Notes
Design and preparation phase	PIU and/or PMO		
	DI		
	EIA units		
	Other		
Construction period	PIU and/or PMO		
	Contractors		
	Engineering/environmental supervision		
	Local EPA		
	Others		
Operation period	PMO		
	PIU and operating units		

Phases	Project stakeholders	Environmental duties	Notes
	Environmental monitoring unit		
	Operation-related competent authorities		
	Other relevant administrative departments		

Table 2. List of environmental impacts and mitigation measures

Phases	Main activities	Negative impacts	Mitigation/control measures	Cost estimates	Executor	Supervisor
Design and preparation phase						
Construction period						
Operating period						

6. Preparation of the final document for EIA Report

After the second round of public participation, the project's Environmental Impact Statement (for approval) and ESMP will be submitted to the PMO, local EPB and WB for internal/external review. EA Consultant will make a summary of the review comments and opinions in the second round of public participation, and prepare the final EIA report.

Qualification requirements for consulting units

SA Consultant must be familiar with WB's safeguard policies, and has rich experience in preparing EIA report. A Consultant shall be competent to prepare EIA report (Chinese & English version) of technical quality, and tackle key environmental issues in project design, construction and operation phases. As the workload is relatively large, EA Consultant shall arrange sufficient experts to accomplish the task.

Annex 2: TOR for environmental audit

In the project implementation period, existing enterprises in technical transformation need to carry out environmental audit (also known as "ecology check" in China) in accordance with the procedural requirements stated in Chapter 5. The work outline is as follows.

Environmental audit is a method for compliance checking of facilities and operation conditions in accordance with applicable regulations, standards and policies; if any disparity is identified, enterprises shall take appropriate mitigation/monitoring measures in accordance with EMP.

WB or China has not yet officially released its guidelines for environmental audit. However, its specific requirements are similar to that for ecology check in China. In June 2003, the former State Environmental Protection Administration issued the Notification on Environmental Auditing of Listed Enterprises and Enterprises Applying for Refinancing (UNCED [2003] No. 101). According to the notification, environmental audit shall be carried out to heavy polluting industries (metallurgy, chemical, coal, thermal power, building materials, paper making, brewing, pharmaceutical, fermentation, textile, leathering and mining) applying for listing or refinancing.

China has not officially released any technical guidelines for environmental audit, but MEP has already prepared comprehensive and systematic training materials for environmental audit. MEP requires that practitioners shall pass the exam for orientation training before engaging in work of environmental audit.

As an official non-formal guide for training of staff for environmental audit, we believe (through analysis and surveys) that the training materials/supporting documents have covered the requirement for environmental audit. In accordance with the actual condition of this project, we put forward specific contents and requirements for environmental audit below.

I. Main tasks and relevant requirements of environmental audit

(I) Implementation of EIA and the “three parallel implementations” principle

> **“Three parallel implementations” system:** in a construction project, the design, construction, and delivery of pollution prevention facilities should be synchronized with the main works. Pollution prevention facilities shall meet the requirements of approved EIA document, and must not be removed

1. Verify the new project, transformation project and expansion project in the audit period based on the data survey and field survey on the enterprise.

2. Audit of EIA and implementation of “three parallel implementations” system includes procedural audit and physical audit.

(1) Procedural audit mainly refers the audit of whether EIA and “three parallel implementations” environmental inspection of completed project are carried out for the various construction projects of the enterprise according to the national and local requirements on environmental protection, and whether such procedures are complete and legal. The initial audit of EIA and that of implementation of “three parallel implementations” system respectively trace back to the issuing and effective date of Regulations on the Administration of Construction Project Environmental Protection (effective on November 29, 1998) and Management Regulations for Checking and

Accepting Environmental Protection of Completed Construction Project (effective on February 1, 2002). Procedural audit shall cover the implementation of EIA and environmental inspection and acceptance of each completed project in accordance with law, including approving organization, approving date and approval document number, and incompliance with relevant laws and regulations shall be disclosed.

(2) Physical audit mainly refers to the audit of whether the environmental protection of the enterprise meets the various requirements proposed in the EIA document and approval document, environmental acceptance and survey document and acceptance remarks. Unlike procedural audit, physical audit does not trace back, and only targets the environmental protection of the enterprise during the audit period. Physical audit is the verification of the implementation of requirements on environment protection one by one according to the EIA document and its approval document, environmental acceptance document and its review reply, and based on the field investigation. The stage of construction project shall be taken into account:

(a) For completed project for which environmental acceptance check has been finished, verify the implementation of the requirements on environmental protection in the acceptance remarks one by one. Explanations shall be provided for significant incompliance with the requirements in the EIA approval document.

(b) For project that has been put into operation but for which environmental acceptance check is not finished, verify the implementation of the requirements on environmental protection in the EIA approval document and the requirements on environmental protection in the production approval document one by one.

(c) For project in progress, analyze and find out whether the environmental activities during the construction process meet the requirements of EIA, including other requirements to be implemented by stages specified in the EIA and EIA approval document, such as the remediation of surrounding environment and relocation that may be involved.

3. Detailed explanation shall be provided for not implementing the requirements of EIA and "three parallel implementations" system or not implementing the requirements on environmental protection as per the approval, and rectification shall be performed.

(II) Compliance with industry policies

Verify the compliance of the technologies used in the production process, production facilities, and products of completed projects, projects in progress and proposed projects with the various requirements of current industry policies and relevant policies on environmental protection issued by environmental protection department.

(III) Implementation of pollution discharge registration, pollution discharge permit and pollution discharge fee

1. Verify the name of pollution discharge application enterprises, application time and confirmation of local environmental protection department according to the pollution discharge application form in the audit period.

2. Verify the number and validity period of pollution discharge permits and permitted discharge of various pollutants in the audit period.

3. Verify the discharge amount of main pollutants of each year in the audit period of the enterprises and analyze whether they are within the discharge permit. The following verification methods can be used according to the specific situation:

(1) The effective data in the pollution discharge application confirmed by environmental protection administrative authority, to be used only in the application year;

(2) The effective data defined in the completed project environmental protection acceptance monitoring report approved by environmental protection administrative authority, to be used only in the year of acceptance;

(3) The effective data defined in the EIA document approved by environmental protection administrative authority, applicable for transformation and expansion of existing project, to be used only in the year of EIA;

(4) Other pollution discharge data confirmed by environmental protection administrative authority, to be used only in the year of confirmation.

The source of data and method used shall be explained clearly, and monitoring data method, material balance method, and discharge coefficient method can be used for the check and verification of the above data.

4. Verify the following performance of the enterprises at the time of the issuance of pollution discharge permit and the time of each renewal of the permit. If any change occurs, the enterprise shall apply to the environmental protection department timely for alteration of the items stated in the pollution discharge permit.

(1) National or local standard of pollutants discharge, total pollutants control target, or environmental functional zoning is changed;

(2) Productivity, technology, equipment, raw materials, products, or the type and capacity of pollution treatment facility of the enterprise are adjusted.

5. In case of incompliance with the above requirements, the reasons shall be explained in detail and rectification shall be performed. If the pollution discharge permit system is not implemented in the area where the enterprise is located, relevant explanation shall be provided by the local environmental protection department.

(IV) Up-to-standard discharge of main pollutants and characteristic pollutants

1. Judgment of up-to-standard discharge of pollutants is based on the monitoring data during the normal operation of the enterprise according to relevant discharge standard, and the following effective pollutant source monitoring data can be used:

(1) Supervision and monitoring data of environmental department at county (district) level or above;

(2) Verified on-line monitoring data;

(3) Environmental protection acceptance monitoring data, to be used only within one year;

(4) Monitoring data of monitoring institutions with CMA certification;

(5) Enterprise entrusted monitoring data;

(6) Other monitoring data.

The historic monitoring data of the enterprise can be used for reference.

2. Monitoring data shall be reliable, authoritative, timely and legal; meanwhile, characteristic pollutants shall be noted, especially heavy metal and toxic and harmful substances; monitoring of unrestrained pollution source and class I sewage pollutants shall

also be noted; requirement of on-line monitoring is proposed for major monitored enterprises.

(1) Formal report and data issued or verified by qualified organization that are in compliance with national and local regulations;

(2) Compliance with relevant national regulations and enterprise EIA document and environmental protection acceptance document in monitoring frequency of pollution source;

(3) Verification by year since the pollution source monitoring data of a certain year can only reflects the discharge of that year;

(4) Monitoring data of main characteristic pollutants is required, with special attention on heavy metal and toxic and harmful pollutants;

(5) Monitoring data of the concentration of main pollutants at site boundary from main unrestrained waste source is required;

(6) If it is required by standard to control the sewage pollutants at the outlet of workshop, the monitoring data of the pollutants at the outlet of workshop shall be provided;

(7) Major monitored enterprises shall meet the national and local requirements on pollution source monitoring.

Incompliance with the above requirements on monitoring data will be deemed as failure to have stable up-to-standard discharge.

3. Since it often happens that the monitoring data provided by an enterprise is very deficient or does not meet requirement, and the pollution discharge of previous years is not traceable, supplementary monitoring on the pollution source is the only method to check whether such enterprise was able to meet the standard of pollution discharge at the previous time. However, supplementary monitoring can only provide one-time data which indicates the current state for reference, and cannot be used for judgment basis of whether the enterprise has “long-term” or “stable” up-to-standard discharge in the audit period.

If any of the following occurs, supplementary pollution source monitoring shall be provided by qualified institutions other than the enterprise:

(1) Effective monitoring data in the recent year within the audit period is missing;

(2) The effects of the rectification of pollution control facilities need to be evaluated during the audit period;

(3) The monitoring data cannot satisfy the requirements specified in the above section 2;

(4) Only the measured data provided by the enterprise is available.

4. If any state or local standard for pollutant discharge is changed in the audit period, the new standard shall be adopted.

5. Demonstrate whether the enterprise can keep the stable up-to-standard discharge of pollutants by considering the operation status of environmental protection facilities.

6. In case of failing to keep the stable up-to-standard discharge, explain the reasons and have rectifications.

(V) Steady operation of environmental protection facilities and automatic monitoring

equipment (if applicable)

Steady and smooth operation of environmental protection facilities is the basis for an enterprise's environmental protection management, pollution treatment, up-to-standard discharge of pollutants and the control of total amount of pollutant discharge. The audit over operation of environmental protection facilities not only includes the monitoring data of pollutant discharge in various monitoring reports but also includes site inspection on the environmental protection measures.

Contents of audit include: the completeness of supporting environmental protection facilities, the reliability of technology and capability of the facilities, the operation status of the facilities.

(VI) Execution of cleaner production (if applicable)

1. Confirm the pollutant generation capacity based on enterprise basic data, and analyze the pollutant production in unit quantity of products (raw materials) by reference to the industrial standard of cleaner production. If no industrial standard is available, the data of similar industries may be referenced.

2. Verify whether cleaner production is audited regularly inside the enterprise and appraised and audited by the competent regulatory authority. According to the *Notice on Deeply Advancing Cleaner Production of Key Enterprises* (No. 54 [2010] of the Ministry of Environmental Protection), the audit cycle of cleaner production shall be: once every two years for five key sectors in control of heavy metal pollution; once every three years for seven sectors with production capacity redundancy; once every five years for other key sectors listed in the *Administrative Catalogue of Industrial Classification for Cleaner Production of Key Enterprises*. For newly founded enterprises, the audit cycle shall start from the time when the environmental protection of main works are inspected and accepted (three parallel implementations), or if project acceptance hasn't be carried out, it shall start from the time of getting approval of trail production.

(VII) Control of heavy mental pollution (if applicable)

1. The discharge of heavy metal pollutants shall conform to state and local standards on environmental protection.

2. For mining & processing of heavy non-ferrous metal ores (including associated ores, such as cooper ores, lead-zinc ores, nickel-cobalt ores, tin ores, antimony ores and mercury ores), heavy non-ferrous metal smelting industry (such as cooper, lead-zinc, nickel-cobalt, tin, antimony and mercury), lead storage battery manufacturing industry, leather and leather products industry (tanning and processing), and chemical raw materials & chemical products manufacturing industry (basic chemical materials as well as paint, ink, pigment and similar products), the enterprise shall establish daily monitoring system of characteristic pollutants, report the monitoring results monthly to the local environmental protection authority, provide online monitoring facilities for heavy metal pollutants and connect it into the network of the environmental protection authority. In addition, the enterprise shall build the environmental information disclosure system to publish annual environmental report to the public and disclose information about heavy metal pollutant discharge and environmental management.

3. According to the *Notice on Enhancing the Control of Pollution Caused by Lead Storage Battery and Secondary Lead* (No. 56 [2011] of the Ministry of Environmental Protection), direct discharge of the untreated acid pickle from broken lead storage battery is strictly

prohibited. The labor protection appliances that have contact with lead fume or dust shall be deemed as hazardous wastes and be strictly managed. The enterprise engaging in lead storage battery and secondary lead shall provide online monitoring facilities and connect it into the network of local environmental protection authority; if failing to provide online monitoring facilities, the enterprise must be capable of self-monitoring, establish daily monitoring system of lead pollutants, and report monitoring results monthly to local environmental protection authority. In addition, the enterprise shall publish annual environmental report to the public and disclose information about lead pollutant discharge and environmental management.

(VIII) Control of pollution from hazardous chemicals and registration of banned substances and new chemicals (if applicable)

1. Control of pollution from hazardous chemicals

(1) For enterprises engaging in hazardous chemicals (such as petroleum processing, chemical raw materials and chemical products manufacturing, medicine manufacturing, chemical fibers manufacturing, non-ferrous metallurgy and textile) in the area where lots of similar enterprises concentrate, along the banks of major rivers, lakes or oceans, along the line of water transfer project, in the densely populated area, in the key ecological function zone, in drinking water source conservation area or other environmental sensitive area, the enterprise shall explain the ground hardening of the sites where hazardous chemicals are produced and processed, the provision of anti-seepage, ventilation and atmospheric pollutant treatment facilities (including wastewater collection and treatment facilities), and the building of three-level environmental prevention and control system.

(2) The enterprise engaging in hazardous chemicals which is shut down or moved to another place shall introduce the assessment information of soil and groundwater at its original location and surrounding area and shall formulate and implement environmental assessment plan.

(3) If any emergency incident of hazardous chemicals ever occurred before? If it did, the enterprise shall explain the causes, the handling process and the problem of secondary environment thus incurred.

2. Verify whether the raw & accessory materials, products and by-products of the enterprise contain any substance banned by the laws and regulations of China or the international conventions singed by China.

3. Check whether the raw & accessory materials, intermediate goods and products used or generated in research, production, importing and processing period contain any new chemical substance. If it does, the enterprise must declare it with competent authority before production or importing and get the registration card for environmental management of new chemical substances.

(IX) Disposition of hazardous wastes and general industrial solid wastes (if applicable)

1. Conclude the types, quantity of production, quantity of comprehensive utilization, quantity of storage and disposition, storage and disposing methods etc.

2. If having storage facilities and landfill for hazardous wastes and general industrial solid wastes, the enterprise shall verify the following information:

(1) Whether the waste treatment capacity of the storage facilities and landfill is sufficient for the production quantity of solid wastes;

(2) Whether the admission conditions, storage method, supporting environmental protection facilities and the discharge of secondary pollutants meet the requirements of relevant standards.

3. If having incineration facilities for hazardous wastes, the enterprise shall check whether the incineration facilities, secondary pollution treatment facilities and discharge of pollutants meet the requirements of relevant standards.

4. If commissioning the comprehensive utilization and waste treatment to an external institution, the enterprise shall provide the commission contract or agreement and introduce the qualification and abilities of the commissioned party. If commissioning the treatment of hazardous wastes to an external institution, the enterprise shall provide the document demonstrating the transfer of hazardous wastes each time.

5. If the storage, treatment, disposal or comprehensive utilization of industrial solid wastes (including hazardous wastes) fails to meet the requirements of environmental protection, the enterprise shall explain the reasons and carry out rectifications.

(X) Execution of ecological protection measures (if applicable)

When the audited enterprise involves ecological environment protection, the enterprise shall introduce the effects of ecological protection measures, including the plan, range, effects and capital inputs of the ecological prevention measures, the plan, range, effects, capital inputs and follow-up of ecological restoration measures, and the methods and implementation of ecological remediation measures.

(XI) Impact on environmental sensitive areas including drinking water source conservation area (if applicable)

In light of the nature of the environmental sensitive area, the requirements of laws & regulations, environmental impact assessment document and project acceptance document, and the impacts brought by enterprise production and operation, the enterprise shall analyze the compatibility between enterprise operation and sensitive area protection.

(XII) Environmental safety risks, emergency response plan and environmental incidents thus incurred (if applicable)

1. Audit the environmental risk prevention measures of the enterprise in combination with site survey of environmental sensitive area near the enterprise, e.g. the completeness of environmental risk prevention measures, and the reasonableness and implementation of the emergency response plan.

(1) Identify the major hazard sources in the enterprise and the distribution of the same with the required methods;

(2) Investigate the risk prevention measures for the identified major hazard sources, e.g. whether these measures meet the requirements, whether they are complete, and whether they are responsive to emergency accidents.

(3) Check whether the enterprise makes emergency response plan for the major hazard sources and the implementation of the plan;

If the environmental risk response plan and prevention measures are not sufficient, the enterprise shall give detailed explanation and have rectifications.

2. Check whether the enterprise had any environmental incident before

(1) Verify whether any environmental incident ever happened in the enterprise by looking up documents, visiting local environmental protection authority and consulting medium information.

(2) In case of any environmental incident caused by pollutant discharge, long term accumulation in resources development or emergency accident, the enterprise shall explain the decision of government authority on this incident, the rectifications carried out by the enterprise and the rectification result.

II. Methods and requirements of enterprise survey

Date survey and on-the-spot survey on enterprises. Data survey is to collect relevant information and understand basic projects, discharge of pollutants and environmental protection measures and so on of enterprise; on-the-spot survey complementally collects and consults the materials that have not been collected in the earlier stage and verifies the information gained from the collected materials one by one.

(I) Collection of main documents

(1) Documents of environmental impact assessment and approval documents of construction projects;
(2) Completion acceptance documents and examination opinions of environmental protection faculties of construction projects;
(3) Declaration and registration documents of pollutant discharge, permit for pollutant discharge, notice on payment of cost for pollutant discharge and payment certificate;
(4) Documents on allocation of total quantity control of pollutants and discharge-reduction task of pollutants;
(5) Pollution source monitoring data, including monitoring data in supervision process, monitoring data in acceptance test, regular entrusted monitoring data and verified online monitoring date and so on;
(6) Comprehensive utilization, treatment and disposal contract of general industrial solid wastes (agreements) and relevant records;
(7) Comprehensive utilization, treatment and disposal contract of hazardous wastes (agreements), qualification certificate of comprehensive utilization, treatment and disposal enterprise and sheets of historical hazardous waste transfer;
(8) Records related to operation and maintenance of production equipment and the supporting environmental protection facilities;
(9) Documents of environmental management system;
(10) Emergency plan for environmental risk accidents;
(11) Examination documents of clean production;
(12) Documents of environmental information disclosure.
Ask for support from enterprises to collect documents that cannot be collected when visiting EPBs.

(II) Basic information of enterprise

Understand the development history of enterprise, including geographic location, name and affiliation relationship in different times, name of construction projects, building time and current operation or construction status, and illustrate why it is the key enterprise under monitoring and control.

(III) Investigation of contents and production technique of main projects of enterprise

(1) Scale, product plan, project composition and main equipment and so on of construction

projects.
(2) Storage and transportation mode and consumption (yield) and so on of raw and auxiliary materials, fuel, fresh water and products. Investigate their gradients and sources when necessary.
(3) Plan layout of plant and main technological production process and so on are represented by key layout of plant, diagram of technological production process and diagram of discharge nodes.

(IV) Basic working method of on-the-spot audit

Public involvement in the discussion can be adopted. Auditors, enterprises and relevant departments hold discussions and take minutes of the discussion. Audio and video recording of the discussion should be taken when necessary.

(V) Records of environmental protection audit

An important principle, i.e. contents described in the technology report should be those viewed and recorded on the spot and reflect the current conditions of enterprise, should be complied with when preparing technology report of environmental protection audit. Some audit authorities often copy the contents of environmental assessment report and completion acceptance report when reflecting the production, conditions of environmental protection facilities and conditions of the surrounding areas of enterprise, which is not consistent with requirements of environmental protection audit.

In order to better achieve the expected effect of environmental protection audit, it is recommended that recording forms should be prepared ahead of time when implementing on-the-spot audit.

Audit and consulting authorities design the tables in accordance with the above requirements for filling at the time of on-the-spot audit. The following tables are only for reference.

Table 1 Main facilities and parameters

Workshop	Facilities	Model & specification	Production capability	Quantity	When constructed	When put into operation

Table 2 New, reconstruction and expansion projects in the audit period

No.	Contents	When project construction is started?	Progress at the time of audit	Environmental assessment document	Final acceptance and approval documents	No.
	new/ reconstruction/ expansion					

Table 3 Environmental sensitive areas near the enterprise

Name	Location	Distance (m)	Size	Remarks:

Table 4 Industrial exhaust pollution control measures

Where pollutants are produced (workshop, process)	Type of pollutants	Environmental protection facilities					Height of exhaust pipe	Remarks
		Name	Model	Technology	Installation position	Installation time		

Table 5 Control measures of exhaust emission in public thermoelectric projects (if applicable)

Type of boiler	Type of fuels	Boiler tonnage	When put into use	Exhaust treatment facilities and technology	Stack height	Remarks

Table 6 Incineration facilities and environmental protection facilities (if applicable)

Incineration scale	When put into use	Source of wastes	Exhaust purification technology	Stack height	Storage & disposal methods of residues	Storage & disposal methods of flying ash	Remarks

Table 7 Unrestrained exhaust emission control facilities (if applicable)

Source of exhaust	Type of pollutants	Control facilities	Using frequency	Effects	Remarks

Table 8 Industrial wastewater treatment facilities

Where wastewater is produced (workshop, process)	Type of pollutants	Contain class-I pollutants or not?	Pretreatment facilities in workshop	Treatment process	Installation position	Reused or not?	Discharge method	Whereabouts

Table 9 Wastewater treatment stations (if applicable)

Location	When constructed	Treatment technology	Treatment capability	Reused or not?	Discharge method	Whereabouts	Treatment method of sludge	Whereabouts	Operation status

Table 10 Comprehensive utilization, treatment, disposal of general industrial solid wastes

Type & quantity of solid wastes	When produced	Temporary storage place/facilities	Comprehensive utilization		Other ways of disposal		Remarks
			Mode	Quantity	Buried quantity	Incinerated quantity	

Table 11 Treatment and disposal of hazardous wastes

Type of wastes	When produced	Temporary storage place/facilities	Comprehensive utilization		Other ways of disposal		Commissioning					
			Mode	Quantity	Buried quantity	Incinerated quantity	Commissioned party	Disposal method	Business scope	Disposing capacity	Sign contract or agreement?	Is there transfer document of hazardous wastes

Table 12 Noise control measures (if applicable)

S.N.	Strong noise source	Location	Vibration reducing & noise reducing measures	Remarks

Table 13 List of environmental risk management and construction of emergency facilities and equipment

Source of major environmental hazards	Emergency facilities and equipment					
	Initial rainwater collection pool	Volume of cofferdam	Automatic alarm device	Spray device	Emergency discharge pond/emergency treatment pool	Leakage prevention facilities of conveying pipeline

Table 14 List of standardized construction of outfall

Types of outfall	Has the signboard of outfall been set	Pollution source number	Has standardized sampling port been set	Has waste gas/water, and pH metering device been set	Location of outfall	Quantity of outfall	Discharge mode	Destination of discharged waste	Remarks
Waste gas									
Waste water									
Noise	Has signboard been set in a standardized way								
Storage place of solid wastes (including temporary storage place)	Has signboard been set in a standardized way					Yes No			
						Yes No			
						Yes No			
						Yes No			
						Yes No			
						Yes No			
Source of major hazards	Has signboard been set in a standardized way					Yes No			
						Yes No			
						Yes No			
						Yes No			
						Yes No			
						Yes No			
Radioactive source	Has signboard been set in a standardized way					Yes No			
						Yes No			
						Yes No			
						Yes No			

Table 15 Implementation of technical renovation measures and rectification measures of environmental protection of enterprise

Pollution accidents and disputes of environmental pollution		
1	Overview	Time: Location: Reason: Dispute settlement process: Response of enterprise: Settlement result:
	Implementation of the settled dispute	Implementation status (implemented, not yet implemented and the reasons): Information on main rectification facilities (name, model, scale, building time and technique):
2	Overview	Time: Location: Reason: Dispute settlement process: Response of enterprise: Settlement result:
	Implementation of the settled dispute	Implementation status (implemented, not yet implemented and the reasons): Information on main rectification (name, model, scale, building time and technique):
3	Overview	Time: Location: Reason: Dispute settlement process: Response of enterprise: Settlement result:
	Implementation of the settled dispute	Implementation status (implemented, not yet implemented and the reasons): Information on main rectification (name, model, scale, building time and technique):

3. Qualification requirements for consulting units

EA Consultant must be familiar with WB's safeguard policies, and has rich experience in preparing EIA report. EA Consultant shall be competent to prepare EIA report (Chinese & English version) of technical quality, and tackle key environmental issues in project design, construction and operation phases. As the workload is relatively large, EA Consultant shall arrange sufficient experts to accomplish the task.

4. Schedule

According to the requirements, the project schedule shall be prepared when work outline is released.

Annex 3: TOR of site remediation

For the enterprises to be closed down or the enterprise with part of the production lines to be closed down due to influence of the project, site environmental survey and assessment have to be implemented to analyze the current sit pollution and the long-term potential impact in accordance with requirements of China and the World Bank. Meanwhile, the remediation measures needs to be put forward in accordance with the future possible usage of the site.

The work outline of site assessment is hereby formulated by combining with relevant technical guides for site pollution that have been issued by China, especially *Guidelines for Environmental Survey, Assessment and Restoration of Industrial Enterprise Site* (trial) promulgated by the Ministry of Environmental Protection of PRC in November 2014. The specific work outline is as follows:

1. Objective and scope

In accordance with relevant laws, regulations, technical standards, technical specifications and relevant policies of China and World Bank's Safeguard Policies OP4.01, site environmental survey and assessment report for the enterprises to be closed down or the enterprise with part of the production lines to be closed down should be prepared in accordance with the procedural requirements as specified in Chapter Five of this policy framework during the project implementation period.

Since the enterprises to be closed have not been determined and it is also harder to determine the usage of land upon closure of the enterprises, the focus is survey on current conditions of the site and assessment on current pollution to lay a foundation for further risk assessment on the polluted site after the usage of such site is determined.

This work outline (TOR) aims to clearly define the procedures, basic requirements and technical methods of environmental survey and assessment of the polluted site, restore the site for owners to hire the consulting agency, implement site survey and risk assessment for the consulting agency and lay foundation for further harness, restoration, environmental monitoring over restoration work, acceptance test over restoration work and post-restoration management.

2. Responsibilities and management mechanism[1]

Subject of responsibility of site undertakes the site environmental survey, assessment and restoration. Subject of responsibility is determined according to the following principles: (1) the units and individuals who cause pollution to the site should undertake the responsibility of environmental survey, assessment and restoration of site; (2) where the units causing pollution to the site are changed due to reorganization, merger and separation and so on, the units inheriting their creditor's rights and debts should undertake the responsibility of environmental survey, assessment and restoration of site; (3) where the units causing pollution to the site have transferred the

[1]Cite Page 9-10, Page 12-13 of *Guidelines for Environmental Survey, Assessment and Restoration of Industrial Enterprise Site* (trial).

land use right according to law, the assignee of land use right should undertake the responsibility of environmental survey, assessment and restoration of site; (4) where the units causing pollution to the site have been terminated due to bankruptcy, dissolution and so on or inheritor of creditor's rights and debts of these units are unable to be determined, the local people's government at county level and above should undertake the responsibility of environmental survey, assessment and restoration of site.

As for industrial enterprise site of demonstration project to be closed down and relocated and the site undergoing closure and relocation, the industrial enterprises of demonstration project should organize environmental survey and assessment on original site and timely disclose the soil conditions and quality of ground water of the site. Where the site is identified as polluted site through site environmental survey and assessment, the subject of responsibility of site should undertake the restoration responsibility, prepare the restoration plan and list the cost for site environmental survey, risk assessment and restoration into relocation cost.

Where industrial enterprise site of demonstration project that is closed down and relocated and is to be developed and used have not been implemented of site environmental survey and risk assessment and the subject that should undertake responsibility of restoration has not been clearly determined, land transfer of the site are prohibited; where the polluted sites have not been treated and remediated, construction of any project irrelevant to the restoration on the sites are prohibited.

In light of industrial enterprise site of demonstration project which has been closed down and relocated and is not to be developed and used for the time being, the subject of responsibility should organize environmental survey and assessment of site. Where the site is not to be remediated for the time being in accordance with environmental survey and assessment of site and the reality, necessary isolation and other risk prevention and control measures should be taken to prevent pollution dispersion and control environmental risks.

Subject of responsibility should entrust professional institute to implement environmental survey and assessment of site and submit the report of environmental survey and assessment of site to the local environmental protection authority at municipality level and above for record. When restoration of site is determined through environmental survey and assessment of site, the subject of site responsibility should entrust professional institute to implement restoration, prepare the restoration plan and submit the plan to local environmental protection authority at municipality level and above for record.

As for the site to be restored, the subject of site responsibility should entrust professional institute to implement environmental supervision on restoration project. Upon completion of restoration, the subject of site responsibility should organize acceptance test on site restoration and final-period management, when necessary. The subject of site responsibility should entrust professional institute to conduct third party acceptance test and final-period management, submit the relevant materials and results to local environmental protection authority at municipality level and above for record and accept supervision and check from local environmental protection authority.

Units undertaking environmental survey, assessment and restoration of site should carry out their work in accordance with *Technical Guidelines for Environmental Site Investigation*, *Technical Guidance for Environmental Site Monitoring*, *Technical Guidelines for Risk Assessment of Contaminated Sites*, and *Technical Guidelines for Site Soil Remediation* as well as this annex and other environmental protection codes and standards.

Site right user and other relevant subject of site responsibility should disclose the information on environmental survey and assessment of site and progress in restoration on portal site and relevant media or print special materials for public access.

3 Main tasks and the requirements

This work outline for site survey has been formulated by combining with relevant technical guides for site pollution that have been issued by China, especially *Guidelines for Environmental Survey, Assessment and Restoration of Industrial Enterprise Site* (trial) promulgated by the Ministry of Environmental Protection of PRC in November 2014.

Environmental survey and assessment of site includes such three stages as the first stage of site survey (identification of pollution), the second stage of site survey (on-the-spot sampling) and risk assessment. The first stage of site survey is preliminary identification and analysis of environmental pollution. When it is believed that possible pollution of the site exists or pollution of the site is unable to be determined, start the second stage of site survey. The second stage of site survey consists of preliminary sampling and detailed sampling. Preliminary sampling is to screen out risks through on-the-spot preliminary sampling and laboratory test. If it is determined that the site has been polluted or has risks, detailed sampling is required and supplementary sampling and analysis will be implemented when necessary to determine the degree and scope of pollution and provide data basis for risk assessment. Then the environmental survey and assessment of site enters into the third stage. The third stage is to determine the acceptability of risk. Environmental survey and assessment of site can be terminated at any of the above stages in accordance with the status of site pollution. The tasks at different stages are hereby described as follows:

Task I: The first stage of survey—Identification of pollution

3.1.1 Objectives and working contents

The objective of the first stage survey is to identify the possible pollution sources and pollutants, first check the possibility of pollution in site and carry out emergency clean-up in the first instance when necessary. Main working contents are to develop survey through information collection and analysis, field survey and interview and so on, analyze environmental pollution of the site and prepare the survey report of the first stage. In principle, on-the-spot sampling analysis will not be implemented.

3.1.2 Methods to identify site pollution

3.1.2.1 Information collection and analysis

Technical personnel of site environmental survey should extensively collect the

information on natural environment, history of environmental pollution, geology and hydrogeology of the site and surrounding areas through information retrieval, interview and telephone consultation and so forth. Information to be collected is based on *Technical Guidelines for Environmental Site Investigation* (HJ 25.1).

3.1.2.2 Field survey

Objective of field survey is to observe the signs of site pollution, verify the accuracy of the collected information and obtain the evidences related to site pollutants in accordance with the field survey on facilities of the site and the surrounding areas. Scope, content and methods of field survey should be subject to *Technical Guidelines for Environmental Site Investigation* (HJ 25.1). Focuses of field survey usually include:

3.1.2.2.1 Suspected pollution source of the site

Observe the location, type, scale and control facilities (such as impermeable materials, structure, degree of aging) of all visible pollution sources; observe and analyze the polluted areas and potential pollution pathway (such as oil pipeline, oil channel and irrigation canal) of the suspected pollutants and possibility of pollution.

3.1.2.2.2 Signs of site pollution

Investigate the signs of site pollution, such as vegetation damages, damage and erosion signs of containers and sewage facilities, odor within the site, stain and erosion signs on the ground, roof and wall and so on. Site pollution characteristics of different industry are different and types of pollutants and links causing pollution are also different. Therefore, field survey should be carried out according to different pollution characteristics of different industry.

3.1.2.2.3 Places related to hazardous substances

Field survey on use and storage of hazardous substances includes:

(1) Types and quantity of hazardous substances being used, containers and storage conditions of hazardous substances, including the quantity and types of storage containers which are not sealed or are damaged.

(2) Storage facilities on and under the ground and conditions of the supporting pipes, recording the quantity, substances being stored, capacity, building year, monitoring data and surrounding pipelines and so on of the storage pool (bunker).

(3) Catch basin of various types and checking whether they contain or are related to hazardous substances.

(4) Checking containers having unknown substances regardless of occurrence of leakage, including quantity and types of containers and the storage conditions.

(5) Whether the site of electric power and hydraulic equipment uses equipment containing PCBs.

(6) Roads and parking facilities within the site and conditions of municipal road adjacent to the site, concentrating on identifying and checking the routes that hazardous substance may be transported.

(7) Whether there are strong smells in the above mentioned sites.

(8) Inquiring the personnel who are familiar with the production line about whether the materials have been completely unloaded from the production line and whether the materials in reaction still, tower, container and pipes have been basically cleaned up. Under the premise that ensuring the health and safety, direct observation can be implemented.

(9) Whether there is obvious pile-up of solid waste in the building and observing its storage; whether there is solid waste in the container and the sealing conditions of container.

(10) Completeness of insulating layer of the equipment and understanding the type and use time of thermal insulation materials.

3.1.2.2.4 Buildings (structures)

Survey on buildings (structures) includes:

(1) Conditions and improvement of the buildings (structures), such as quantity, stories and years of the building.

(2) Floor decoration in production devices area, storage area and waste disposal places, whether there are stain and erosion signs on ground, roof and wall due to erosion and leakage of production devices.

(3) Types and storage of cold and hot media used by heating and refrigeration system.

(4) Thermal insulation conditions of buildings (structures) and various pipelines, especially the use and storage conditions of asbestos.

(5) Outdoor floor decoration and stain signs on floor of areas other than production devices area, storage area and waste disposal place and abnormal growth of plants due to pollution in outdoors of these areas.

(6) Quality of production sewage, the use of relevant treatment structures (such as drain pipe, drainage ditch and pool and so on), building year and technique of sewage treatment system and so on.

(7) Obviously piled up construction wastes or construction wastes abandoned by filing or other mound and depression formed by solid waste and so on.

(8) Whether there are abnormalities in color and odor of water in all wells within the site.

3.1.2.2.5 Surrounding areas

Field survey on the surrounding areas should be conducted and the scope should be determined by the filed survey personnel in accordance with contaminants transport and the survey on surrounding areas includes:

(1) Enterprises in surrounding areas of the site, including sources and types of pollutants discharges of these enterprises, and analyzing whether they are connected to the site pollution.

(2) The surrounding polluted sites that have been determined, concentrating on investigating the pollutants of those sites and environmental impact and pollution pathway of those pollutants on the site.

(3) Observing and recording the residential areas, schools, hospitals, protection areas for drinking water resources and other public places in the site and surrounding areas that may be affected by pollutants and clearly defining the relationship between their location and the site in the report.

3.1.2.3 Interview

Interview the personnel who are familiar with the site through consultation and questionnaire and so on, including the officials of site management department and local government, officials of competent environmental protection authority, past and present users of the site, staff members and residents of the adjacent sites and so on. The contents, objects, methods and contents of interview and the analysis should be subject to *Technical Guidelines for Environmental Site Investigation* (HJ 25.1).

3.1.3 Emergency clean-up of the site pollution

If it is found in the process of field survey that there is hazardous substance leakage in the site and surrounding areas, quick assessment on leakage conditions and damage degree of the leakage should be carried out to determine whether immediate measures should be taken to remove the source of leakage. Once emergency clean-up is necessary, immediate notice to the relevant department should be given and emergency measures should be taken.

Rapid assessment usually consists of the following four steps: first, collect the information on the accident and pollutants and basic information on hydrology; second, judge the harms and degree of urgency of accident and its impact on the sensitive points around the site through experience judgment and simple mathematic model and rapidly gain the information needed; third, comprehensive analyze the information gained in the previous two stages, make decisions and formulate the site emergency control measures; four, implement the emergency measures, assess its effect and determine whether further measures are required.

3.1.4 Analysis and judgment

Objective of analysis and judgment in the stage of identification of pollution is to find out the possible pollution. If signs of pollution are found or existence of potential pollution is deemed and possibility of pollution is unable to be determined, such as, it is unable to determine whether the site where no sign of pollution is found but hazardous chemical products and oil production are used in the production or poisonous and harmful substances are drained is polluted or not due to unclear historical conditions, such site should be deemed as potential polluted site.

If it is judged that the site may be polluted, preliminary conceptual model of the site should be further established. Conceptual model of site is a relationship model which comprehensively describes that pollutants of sources of site pollution enter into human body through soil, water, air and other environmental media and exert impact on health of people residing and working in the site and the surrounding areas in the

future. Conceptual model of site pollution should include:

(1) Types of pollutants: analyzing the types of possible pollutants of the site in accordance with the conditions of production technique, raw and auxiliary materials, products types and "waste gas, waste water and waste residue" and secondary pollutants generated by the residual primary pollutants in the physical and chemical process.

(2) Potential polluted areas: analyzing the potential polluted areas in accordance with production devices, pipelines, storage facilities of hazardous chemical products and oil products, discharge of pollutants, pollution signs of the site and characteristics of contaminant transport.

(3) Analysis of hydrogeological conditions: analyzing the stratigraphic distribution, characteristics of ground water distribution and other hydrogeological conditions that influence transport and conversion of pollutants in the environmental media by combining with characteristics of pollutants.

(4) Analysis of the characteristics of pollutants and its transport in environmental media:

1) raw and auxiliary materials and products enter into the surrounding environment due to leakage, volatilization and accidents in the transportation process;
2) waste gas and smoke (dust) generated in the production process spread to the surrounding area of production facilities and even areas outside of the plant;
3) waste water enters into the soil and ground water due to rupture of drainage ditch;
4) pollutants of the scrap pile enter into the nearby rivers along with surface runoff due to action of rainfall;
5) Pollutants of scrap pile or polluted soil enter into the ground water due to action of rainfall and transport towards the direction of ground water flow.

(5) Analysis of sensitive receptors: analyzing and determining the people that will be influenced by the polluted site in the future in accordance with the future planning of the polluted site.

(6) Analysis of exposure pathway: analyzing and determining the exposure points that people will contact with pollutants in the future and analyzing and setting up the exposure pathway in accordance with the law of people's activities and transport law of pollutants in environmental media.

(7) Identification of hazards: preliminarily identifying the hazards of pollutants in the site on the basis of the above mentioned analysis. If it is deemed that the site is not polluted through the first stage of environmental survey of site, then the environmental survey of site ends and report of the first stage of environmental survey of site will be prepared.

Task II: The second stage of survey - on-the-spot sampling

3.2.1 Objective and working contents

The second stage of survey focuses on sampling analysis and determining the types and distribution of pollutants in the site as well as pollution degree. The main working contents are preliminary sampling, screening of site risks, detailed sampling and preparation of the second stage of survey. Preliminary sampling is also called as determination of sampling which mainly analyzes and confirms whether there are potential risks in the site and concentrates on the pollutants through comparison of risk screening; objective of detailed sampling is to determine the specific distribution of pollutants and pollution degree.

For the specific sampling methods and requirements, please refer to *Guidelines for Environmental Survey, Assessment and Restoration of Industrial Enterprise Site* (trial) and *Technical Guidelines for Environmental Site Investigation* (HJ25.1-2014). Except soil sampling and groundwater sampling, portable instrument and geophysical exploration technology are frequently used in site pollution survey at present.

Task III: The third stage of survey—risk assessment

3.3.1 Objective and working contents

Objective of the third stage is to determine whether the health risk caused by site pollution is acceptable through risk assessment and define the restoration scope according to preliminary restoration goal of site.

3.3.2 Procedures and method of risk assessment

Health risk assessment of site is quantitatively estimating the probability that carcinogenic contaminant causes harms to health of human body or the damage degree (entropy of damage) of non-carcinogenic contaminant on the basis of analyzing that pollutants in soil and ground water of the site enter into human body through different pathway. Its main contents are identification of hazards, exposure assessment, toxicity assessment and risk characteristics. The working procedures are shown in Figure 3.1.

3.3.2.1 Identification of hazards

Main task of identification of site hazards is, in accordance with information gained through survey, sampling and analysis of the first and second stages and combining with planned nature of land use of the site, to determine the contaminants of concern and its spatial distribution, identify the types of sensitive acceptor, further improve conceptual model of site and guide the risk assessment of site. Contents of identification of site hazards include:

(1) Determining main source of pollution, concentration of pollutants and the way they are released to the environment. Calculation method of concentration of site pollutants is shown in annex 3.

(2) Analyzing and determining the people who will be affected by the polluted site in the future in accordance with future land utilization plan of the polluted site.

(3) Analyzing the transport and conversion of pollutants in environmental media in accordance with characteristics of pollutants and environmental media.

(4) Analyzing and determining the way that people contact or intake pollutants in the future and determining the exposure mode in accordance with law of people's activities in the future and transport law of pollutants in environmental media.

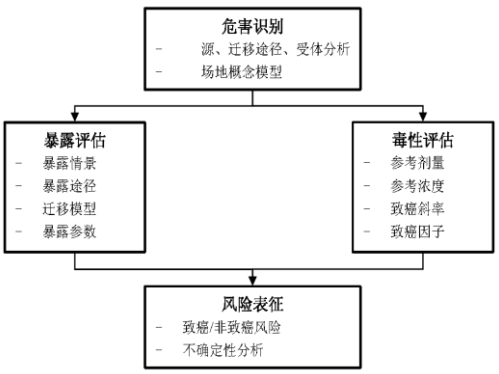
(5) Analyzing and setting up exposure pathway on the basis of analysis of the pollution sources, transport and conversion of pollutants in the environment, exposure mode and acceptor.

(6) Comprehensively considering various exposure pathways and setting up conceptual mode of site pollution. Conceptual mode of site pollution should be further improved and revised in the subsequent exposure assessment and risk assessment.

In the risk assessment, if risk chain of "pollution source-transport pathway-acceptor" between the pollution source and acceptor is not formed, then it is deemed as no risk exists and risk assessment will be stopped.

Figure 3.1 Risk Assessment Procedures of Site Pollution

危害识别	Identification of hazards
源、迁移途径、受体分析	Sources, transport pathway, acceptor analysis
场地概念模型	Site conceptual model
暴露评估	Exposure assessment
暴露情景	Exposure scenario
迁移模型	Transport model
暴露参数	Exposure parameters



毒性评估	Toxicity assessment
参考剂量	Reference dosage
参考浓度	Reference concentration
致癌斜率	Carcinogenic ratio

致癌因子	Carcinogenic factors
风险表征	Risk characteristics
致癌/非致癌风险	Carcinogenic/non-carcinogenic risks
不确定性分析	Uncertainty analysis

3.3.2.2 Exposure assessment

On the basis of identification of hazards, exposure assessment is to analyze the scenario that contaminants of concern in soil and ground water of the site enter into the acceptor and cause harms to the acceptor, determine the exposure pathway of pollutants in soil and ground water of the site to the sensitive people, determine the transport model of pollutants in environmental media and exposure model of the sensitive people, determine the site pollution conditions, soil nature, characteristics of ground water, the sensitive people and nature of contaminants of concern and parameter value of other relevant models and calculate the sensitive people's exposure to pollutants in soil and ground water. Main contents of exposure assessment include analysis of exposure scenario, identification of exposure pathway, selection of transport model and determination of exposure parameters.

3.3.2.3 Toxicity assessment

Adverse effect of common pollutants on human body is represented by dose-response relationship. It is usually considered that there is a threshold for non-carcinogenic substances, such as substances with neurotoxicity, immune toxicity and developmental toxicity, namely, adverse effect will not be observed when the dose is lower than the threshold. It is usually considered that there is not a threshold for carcinogenic substances and mutagenic substances, namely, any doses of such substances will exert adverse effect on health.

The common toxicity parameters of pollutants can be viewed in *Technical Guidelines for Risk Assessment of Contaminated Sites* (HJ 25.3) and can also be updated timely in accordance with internationally recognized toxicity database.

3.3.2.4 Risk characteristics

3.3.2.4.1 Calculation of carcinogenic/non-carcinogenic risks

Risk characteristics is to represent the risk occurrence probability and/or degree of damages with certain quantitative indicators on the basis of results of hazards identification, exposure assessment and toxicity assessment of the site so as to determine the degree of damages that the people is exposed to pollutants. Its main working contents include: calculating the entropy of carcinogenic and non-carcinogenic hazards of single pollutants through certain exposure pathway, the entropy of carcinogenic and non-carcinogenic hazards of single pollutants through all exposure pathways and the entropy of cumulative carcinogenic and non-carcinogenic hazards of all contaminants of concern. Calculation formula of risk characteristics can be viewed in *Technical Guidelines for Risk Assessment of Contaminated Sites* (HJ 25.3).

3.3.2.4.2 Uncertainty analysis

Comprehensive analysis and assessment of uncertain factors in risk assessment process is called as uncertainty analysis. Uncertainty analysis of risk assessment results of the site is mainly to qualitatively or quantitatively analyze the uncertainty over simulation results of the models due to parameters errors and uncertainty of the models themselves in the process of risk assessment of the site, including analysis of contribution ratio of risk and parametric sensitivity and so on. The specific methods of uncertainty analysis can be viewed in *Technical Guidelines for Risk Assessment of Contaminated Sites* (HJ 25.3).

3.3.3 Determination of risk control value

3.3.3.1 Determination of the risk acceptability

Risk acceptability refers to health risk level which is acceptable to the people under certain conditions. Level of carcinogenic risk is measured by occurrence probability of cancer which may be caused by pollutants in soil and ground water of the site and entropy of non-carcinogenic hazards is measured by multiple that the concentration of pollutants in soil and ground water of the site is more than the acceptable concentration of pollutants.

Under normal conditions, the acceptability of carcinogenic risk of single pollutant is set as 10-6 and entropy of non-carcinogenic hazards is set as 1. Risk acceptability directly affects restoration cost of the polluted site and suitable risk acceptability can be chosen in accordance with local social and economic development level in the specific risk assessment process.

3.3.3.2 Calculation of risk control value of site

Risk control value of site is also called as objective value of preliminary restoration and is a limit that concentration of pollutants in soil and ground water of the site need to reach after restoration and which is comprehensively determined in accordance with pollution acceptability, background value of the site, economic and technological conditions and restoration method (restoration and project control) and local social and economic development level.

Calculation of objective value of restoration includes calculating the objective value of restoration of carcinogenic risk and entropy of non-carcinogenic hazards of pollutants in soil and ground water through single exposure pathway and calculating the objective value of restoration of carcinogenic risk and entropy of non-carcinogenic hazards of pollutants in soil and ground water through all exposure pathways. When there are multiple exposure pathways of site pollutants, the second method is usually adopted, namely, calculate the cumulative risk of pollutants through all exposure pathways and then calculate the objective value of restoration.

Methods of calculating risk control value of single exposure pathway and comprehensive exposure pathways can be viewed in *Technical Guidelines for Risk Assessment of Contaminated Sites* (HJ 25.3).

Calculate the objective value of restoration in accordance with carcinogenic risk and entropy of non-carcinogenic hazards of pollutants through the exposure pathway

respectively, then compare the calculation results, and finally choose the smaller value as the objective value of restoration of the polluted site.

Objective value of preliminary pollution restoration is the calculation value based on risk assessment model and an important reference value used for determining the objective value of polluted site. In determination of final restoration objective of the polluted site, the ultimate transportation destination of the soil and utilization method of soil after restoration, selection of restoration technology, restoration time, restoration cost, laws and regulations and social economic factors and so on should also be considered.

Task IV: Preparation of restoration plan (If the re-usage of site is clearly determined)

If the re-usage of land is determined, site restoration plan needs preparing. Goal of preparing site restoration plan (also called as the feasibility study) is to determine the best restoration technology and plan suitable for the target site in accordance with results of site survey and risk assessment and formulate the supporting environmental management plan to provide basis for implementation of the restoration plan of the target site and support the environmental management decision making related to such site.

Find out the potential feasible technology with the overall restoration goal and strategy as the core, by investigating and studying the frequently-used restoration technology and comprehensively considering the restoration effect, feasibility and the cost and so on and determine the best feasible restoration technology suitable for the target site on such basis. Screening and assessing the restoration technology mainly includes such three processes as screening the restoration technology, assessing the technology feasibility and quantitatively assessing the restoration technology. Of which, the technology feasibility assessment can also be divided into screening tests and selection tests based on the different goals and means of tests.

Contrasting selection of plan is to determine the best restoration technology plan suitable for the target site by comparing the various potential alternative restoration technology plans from the aspects of technological, economic, environmental and social indicators. The phase of forming the alternative restoration technology plan and contrasting selection of plan mainly include two processes like forming the alternative restoration technology plans and selecting the plan through contrasting various alternative plans.

3.4.4 Formulation of environmental management plan

Environmental management plan provides guidance for implementation of restoration of the target site, prevent the second pollution of the site during restoration process and provide technical support for environmental monitoring and management in the restoration process. Preparation of environmental management plan mainly includes such four processes as putting forward the pollution prevention and measures to protect personnel safety, formulating the environmental monitoring plan of the site, formulating restoration and acceptance test plan of the site and formulating environmental emergency plan.

4. The prepared reports

4.1 Survey report of the first stage (identification of pollution)

In accordance with the above mentioned tasks and requirements, the survey report of the first stage should contain the following:

1 Overview (Introduction)

2 Geographic location and natural environment of the site

3 Ownership and utilization of the site and surrounding land
3.1 Ownership of the site in the past and at present
3.2 Historic overview of site usage
3.3 Usage of the site land at present
3.4 Land use planning in the future
3.5 Ownership and land usage of the surrounding areas in the past and at present
4 Site environmental survey
4.1 Investigation of activities on the site
4.1.1 Description of the site environment
4.1.2 Existing buildings on the site
4.1.3 Production techniques and scale
4.1.4 Production facilities and discharge of pollutants
4.1.5 Storage facilities of tanks and grooves, distribution of sewage pipelines and pollution
4.1.6 Operation, usage and instrumentation in labs
4.1.7 Log sheet of main infrastructures
4.1.8 Other information
4.2 Environmental pollution survey of the site
4.2.1 Wastewater
4.2.2 Solid waste
4.2.3 Toxic and harmful substances
4.2.4 Survey of pollution accidents
5 Analysis and judgment of site environment
6 Conclusion and suggestions
Appendix: site figures (including floor plan, process flow diagram, site photos, etc.); record of change of site owners, photos, usage of chemicals and facilities, past monitoring data of soil and ground water, monitoring data of pollutant discharge, and record of past site restoration activities.

4.2 Survey report of the second stage (on-the-spot sampling)

In accordance with the above mentioned tasks and requirements, the survey report of the second stage should contain the following:

1 Overview
2 Survey report of the first stage –Identification of pollution (refer to the survey at the

Annex 4 Pest Management Plan

Chapter 1. Introduction

The Pest Management Plan (PMP) of this Project is developed according to the requirements in Regulation on Pesticide Administration and Regulation on Plant Quarantine issued by the State Council as well as the World Bank policy (OP 4.09) on "Integrated Pest Management". This Plan is developed to ensure the smooth implementation of RIFA Control Project under the World Bank/GEF project for China's Compliance with Stockholm Convention.

On August 30, 2013, the Standing Committee of National People's Congress (NPC) approved the amendments of Stockholm Convention on Persistent Organic Pollutants (POPs), and nine POPs including Perfluorooctanesulfonic acid, its salts and Perfluorooctanesulfonyl fluoride (PFOS/PFOSF) are added to the list of the controlled substances of the Convention. In order to promote the elimination and substitution of PFOS/PFOSF substances, the Foreign Economic Cooperative Office (FECO) under the Ministry of Environmental Protection cooperated with World Bank in developing a project "Program on Reduction and Substitution in PFOS Priority Industries in China" with the aim to help China fulfill the obligation related to PFOS established in POPs Convention. Sulfluramid (a PFOS substance) is registered for the control of red imported fire ant (RIFA) in China which takes a considerable market share. However according to the amendments of POPs Convention, Sulfluramid has to be phased out and substituted by March 2019.

In order to deal with the pest management issues properly in the eliminating and substituting process of Sulfluramid, this Pest Management Plan is hereby prepared. The PMP assesses the regulatory framework relevant to project implementation, evaluates and selects alternative RIFA controlling pesticides and methods presently available on the market. The PMP also assesses the potential environmental, health and safety risks associated with the selected alternatives. This plan designs necessary capacity building and monitoring & evaluation activities, aiming at phasing out the sulfluramid effectively and promoting the integrated management of RIFA in China.

Chapter 2. Red Imported Fire Ant and its Damage

2.1 I. Red Imported Fire Ant and its Distribution in China

Red imported fire ant (RIFA), *Imported fire ant* (Buren) is native to South America and is believed to have been distributed along the Parana River passing through Brazil, Paraguay and Argentina. The ant can spread naturally with wind and water ways and with human related activities such as transport of host materials (green plants, wood, *etc*.). Long distance dispersal is believed to have increased with international trade (movement of cargo ships, trucks and cars). Compared with other species of ants, RIFA is a much more "successful" pest as it was able to out-compete and displace other species as well as develop in disturbed habitats (*i.e.* flood plains) and survive on a wide variety of food sources (*i.e.* seeds, seedlings, insects, *etc.*) .

The RIFA has strong fecundity, e.g. a mature ant nest can produce 4,500 reproductive gynes per year with a very high potential for nest amplification and a queen ant can

produce 800-1,000 eggs every day, and owns a certain spreading ability by mating flight (3-5 km). In addition, the ant is rather difficult to control because of its biology and limited adequacy of treatment methods used. As a result, RIFA keeps spreading across the world. RIFA was first found in Taiwan in September 2003 and in Chinese Mainland, it was first found in Wuchuan, Guangdong Province in September 2004.

After RIFA was introduced into Chinese mainland, relevant departments have adopted a series of control measures, including determination of its quarantine status, implementation of the official control and quarantine supervision strengthening, which to a certain extent delayed the RIFA outbreaks, but cannot stop its spread across the country. Since 2010, RIFA has been widely distributed and spreading from multiple sources, displaying accelerated spread trend (see Figure 1). In 2013, RIFA occurred in 169 counties (cities and districts) of 7 provinces (districts), with the occurring area of 1,910,000 mu; in 2014, it occurred in 217 counties (cities and districts) of 9 provinces (districts), with the occurring area of 2,310,000 mu; and in 2015, it further spread to 246 counties (districts and cities) of 10 provinces[2] (autonomous region and municipality), with the occurring area of 2,560,000 mu.

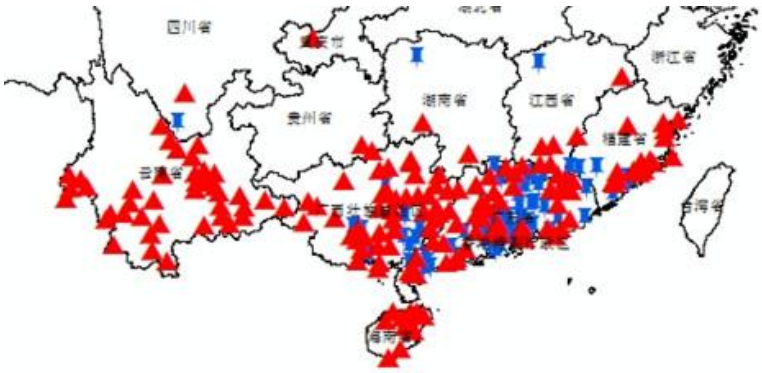


Figure 1. Contrast of RIFA Occurrence in 2010 and 2015 in China

Note: Blue represents the occurring area in 2010 and red represents the newly increased occurring area from 2011 to 2015.

2.2 II. Damage of Red Imported Fire Ant

RIFA is characterized by its aggressive nature, with strong competitive power, and can easily form a population of high density in any newly invaded area. It is classified as one of the 100 most destructive invasive species by International Union for Conservation of Nature (IUCN), and also is called "ecological killer". Its harm is mainly manifested in the following respects:

Impact on Human Health. The venom of RIFA is a water-soluble protein. After human bitten by it, severe pain can be felt, and then water vacuole and suppuration will appear; allergy and even death may happen in severe cases of allergic reactions. In 1998, 33,000 people in South Carolina, USA sought medical advice because of being stung by RIFA, among which 660 people suffered anaphylactic shock and two people died. Though RIFA has not been in China for a long time, the accumulated

[2]Namely Guangdong, Guangxi, Fujian, Hainan, Yunnan, Jiangxi, Hunan, Sichuan, Chongqing and Guizhou.

number of people that have been stung by RIFA is over 600,000 person times, among which more than 105 severe cases were reported on the Internet, mostly in Guangdong Province, Guangxi Province and Fujian Province. A hospital in the urban and rural linking area in Guangzhou city has received and treated almost 300 patients with severe allergic reactions caused by ants in a year; and more than 70% of the villagers in a village in Guangzhou city have been stung by RIFA.

Impact on Agroforestry and Livestock Production. RIFA is omnivorous insect, eating crop seeds, tender shoots, root systems, fruits and seedlings. It has been proved that it can harm more than 50 kinds of crops. According to the survey, RIFA harms the seeds of 14 kinds of plants (crops) with rate of seeds scarified, rate of seeds removed and rate of seeds discarded of more than 40%, which results in that the rate of seeds germination is less than 50% in some cases, and rate of seeds germination of corn and mung bean seeds in the occurring area decrease by 14% and 7.4% respectively. In some areas, serious threat to the farm operation due to RIFA can lead to deserted farmland, e.g. 1,000 mu of farmland has become idle due to RIFA in Huizhou City, Guangdong Province. RIFA also causes harm to poultries and livestock, increasing diseases or reducing production efficiency. For instance, several pig farms in Zhucun Village, Zengcheng District, Guangzhou City are filled with ant nests (generally from dozens to 100) all around, and RIFA workers move around in the breeding houses, which cause that more than 25% of piglets and more than 10% of growing and fattening pigs are stung by worker ants, and their normal growth and development are affected.

Impact on Public Safety. Since RIFA can be attracted by magnetic field in the current, it is habituated to build ant nests near the electrical equipment, such as that electricity meter, telephone exchange case, traffic electromechanical equipment boxes, airport runway indicator lights and air-conditioner are RIFA's favorite places for building nests. The activities of RIFA often cause wire short circuit or facilities fault, consequently impacting the public safety. RIFA entered and built nests in two electrical boxes of a fruit grower's house at Dashanjiang Street, Wuchuan City, Guangdong Province, which led to the electrical boxes burnout due to short circuit; RIFA entered and built nests in four street lamps and one distribution box in the greenbelt in Ersha Island, Yuexiu District, Guangzhou City, and three street lamps and the distribution box were damaged due to short circuit.

Impact on Ecosystem. Since RIFA has competitive advantage in the habitat, it can prey on a large number of other animals such as arthropod, which results in sharp decline in biodiversity in the habitat, and even extinction of some local species. RIFA's introduction to North America greatly reduces the richness and diversity of local ants and in the seriously invaded areas, only 30% of the local ant population remains. There are many invertebrate species eaten by RIFA, and according to research report, invertebrate species richness in some areas invaded by RIFA could fall to 40% of the original richness. Researches show that RIFA also can significantly impact the diversity and richness of vertebrate in the occurring areas. The ants' invasion to south China has negatively impacted the structure and function of plants and arthropods of many kinds of ecological systems. For example, RIFA's invasion seriously impacts the ecosystem of litchi orchard by replacing and changing the former dominant ant species and changing the soil property in the orchard.

2.3 III. Occurrence Prediction on Red Imported Fire Ant

RIFA with strong fitness can survive in the areas with average annual temperature over -12.8℃. In recent years, a number of experts have carried out the fitness research on RIFA in China using Climex and GARP models, and the results show that 25 provinces (districts and cities) in total, ranging from Hainan Province in the south to Hebei Province in the north, and from eastern coastal in the east to northwestern inland in the west, may be invaded by RIFA. RIFA currently has appeared in 246 counties (cities and districts) of 10 provinces (districts and cities) in China, which means that epidemic transmission sources have increased greatly compared to its first introduction to China. Since nowadays transmission media such as turf grasses and ornamental plants are allocated and transported more frequently, RIFA is bound to diffuse speedily, causing aggravated harm. According to the results of prediction on RIFA spread trend, if there is no effective control measures in place, RIFA will spread rapidly in a period of time in the future (within 20 or 30 years). More than 30 counties (cities and districts) will be added to the domain of RIFA invasion every year, which demonstrates a spreading pattern combing gradual diffusion from areas of widespread distribution to surrounding areas free of RIFA and continuously jumpy invasion in new areas over a long distance (see Figure 2).

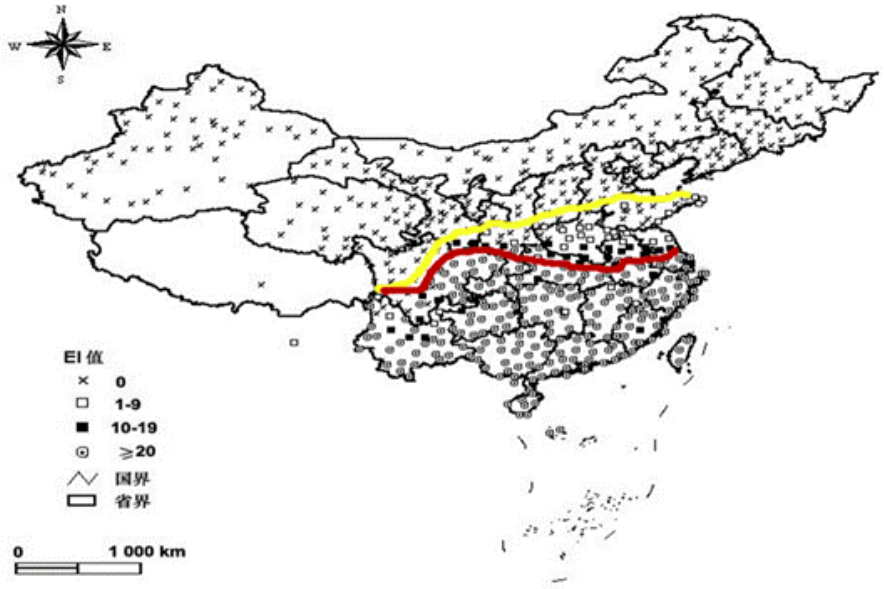


Figure 2. Potential Occurring Areas of RIFA in China

(Adapted from Wang Fuxiang and Zhang Runzhi in 2005)

Note: The southern area to the yellow line is suitable area and the southern area to the red line is the most suitable area.

Chapter 3. Regulatory and Institutional Framework

3.1 I. National Legislation

Quality and Safety Law of Agricultural Products has been adopted by the NPC which provides for the pesticide management with a view to safeguarding the safety of agricultural products. The law came into force on Nov. 1 2006. Article 21 of the law specifies: The competent authority of agriculture under the State Council and under the governments of provinces, autonomous regions and municipalities shall regularly monitor and make on-site check of the pesticide. In addition, selling the agricultural products containing the pesticides prohibited for use or the level of pesticide residue noncompliant with national standards shall be prohibited.

Regulation on Pesticide Management developed in 1997 and revised in 2001 by the State Council lays the legislative foundation of pesticide management in China. The regulation is composed of 8 chapters and 49 articles, including the regulations on pesticide registration, pesticide production, pesticide operation, pesticide use and others. **Pesticide registration:** This chapter introduces the pesticide registration system in China. The pesticide registration system is implemented in three stages of field trial, temporary registration and formal registration in China. The pesticides used in field experiments shall beforehand be registered for field trial. They shall pass the temporary registration before trial demonstration and trial selling, and can only be sold as legal products with formal registration. **Pesticide production:** This chapter introduces pesticide production license system in China. The pesticide manufacturers shall have necessary personnel, equipment, safety system, quality assurance system and environmental protection, and labels and manuals must be attached to the pesticide. **Pesticide selling**: This chapter specifies 7 business entities including the agricultural material trading bodies of the supply and marketing cooperatives and the plant protection stations as well as their necessary personnel, facilities, protective measures and rules and regulations. **Pesticide use**: This chapter specifies the responsibilities and obligations of the agriculture administration departments of governments at all levels in terms of the prediction and report of pests, technical training and pesticide directions. It is also clearly specifies that pesticide residues should be handled and spraying workers should be protected properly and highly toxic pesticides shall not be used in the public health insect prevention, vegetables, fruits, tea and Chinese medicinal herbs. **Other regulations and penalties:** This chapter specifies the prohibited events, including pesticide production without license, production, selling and use of fake pesticide, as well as the corresponding punishment measures.

3.2 II. Departmental Rules

The Ministry of Agriculture (MOA) and relevant Ministries have issued a series of departmental rules with the so-called “six new regulations” as core. In terms of the large amount of products, “one pesticide with several names”, irregular label management and other major problems in pesticide registration management in China, MOA issued Decision on Amending the ‘Measures for Implementing the Regulation on Pesticide Administration’, Regulations on Pesticide Registration Data, Administrative Measures for Pesticide Labels and Manuals and announcement on

management of pesticide name registration and approval on Dec. 8 2007. In addition, MOA and National Development and Reform Commission jointly issued the announcements on regulating pesticide naming and active ingredient content on Dec. 12. “Six new regulations” mainly include: (1) Since Jan 8 2008, the commodity name shall not be approved, and the common name and simplified common name shall be adopted as the pesticide name; since Jul 1 2008, the commodity name shall not be adopted by pesticide product. (2) The accumulated validity period of certificate for pesticide temporary registration is changed from 4 years to 3 years. (3) When the renewal is applied for the approved pesticide with formal registration, the absent test data or comprehensive reports shall be added for the reassessment according to the new regulations. (4) The threshold for pesticide registration is raised and the difference between temporary and formal registration is reduced. Especially the requirements of temporary registration on pesticide residue are improved to ensure the quality safety of agricultural products. (5) The pesticide labels and manuals management shall be regulated to further define the information that shall be and shall not be marked on the label. In addition, the pesticide name shall be marked on the obvious position of the label, while the single character area marked on the label shall be no more than that of product name. (6) The active ingredient content of pesticide shall be regulated, i.e., less than five gradients of active ingredient content shall be set for the products with the same active ingredient content and type. The active ingredient content shall not be reduced for the pesticide with penetrant and synergist.

3.3 III. Technical Standards

The technical standards are an important part of pesticide management policy frame in China. At present, more than 200 national and industrial product standards, nearly 400 methods standards, nearly 100 safety standards and more than 30 intoxication emergency and environmental safety standards are prepared in terms of pesticide management. Where, the major fundamental standards include the Chinese common name for pesticide, the standard preparation regulation for fungus pesticide & technical concentrate, powder, wettable powder, oil suspended agent and bait, the pesticide registration management terminology, the naming principle and procedure of pesticide comment name and formulation name, the guideline on pesticide residue trials, the sampling method of pesticide residue analysis sample and the guideline for field experiments of pesticide (I) and (II).Environmental safety standards mainly include *Standards for Safety Application of Pesticides, Technical Guideline on Environmental Safety Application of Pesticides* and the serial *Test Guidelines on Environmental Safety Assessment for Chemical Pesticides* (including 21 parts such as transformation in soils, hydrolysis).

3.4 IV. Special Pesticide Registration System

The details of special pesticide registration system are specified in the *Regulation on Pesticide Administration* and supporting rules and regulations. According to the *Regulation on Pesticide Administration*, the corresponding producer shall apply for temporary registration of the pesticide necessary for special cases after the field trial. Article 7 in Measures for Implementing the Regulation on Pesticide Administration specifies: In terms of the pesticide necessary for the special cases, the corresponding producer shall apply for the temporary registration of active compound and

formulation after the field trial; Article 16: In emergency cases, the unregistered, forbidden or restricted pesticide may be used or temporarily imported within a certain range and period under the agreement and approval of agricultural departments and relevant departments. *Regulations on Pesticide Registration Data* specifies: Regarding the public health pesticides, rodenticides and biochemical pesticides not covered in the Regulations, of which the exemption data is required, the applicant shall submit the written application attaching with relevant data to Institute for the Control of Agrochemicals, MOA (ICAMA), and then MOA will make decision after the review of Pesticide Registration Reviewing Committee or Temporary Pesticide Registration Reviewing Committee.

The pesticide registration of RIFA and other quarantine pests has drawn much attention due to the serious hazard in recent years. In Feb. 2006, ICAMA held the seminar about the registration management of pesticide controlling RIFA, and the preparation of the registration management regulation on special (urgent) pesticide was discussed. Thus in order to guarantee the rapid registration of urgent pesticide and the implementation of emergency plan of controlling major epidemic, the emergency measures and plans of special (urgent) pesticide registration management in major epidemic and disaster was proposed. At the beginning of 2010, "The Third High-Level Forum on China Pesticide" meeting was held in Beijing, MOA proposed to solve the registration management problems of pesticide (including the quarantine pest pesticide) used on a small scale through guiding the enterprise to make joint registration.

However, no detailed provisions of the registration data requirements and registration procedure of special pesticide are included in relevant laws in China so far which results in a low operability and hence affects the special pesticide registration. Therefore, the relevant supporting regulations shall be prepared for implementing the regulations of special pesticide registration management, including the illustration of the basic principle of special pesticide registration, the essential conditions of applying for the pesticide, the requirements of submitted active compound and formulation data, the procedure of building and launching special pesticide registration management and the detailed regulations of its monitoring and management after registration.

3.5 V. Relevant Policy and Law of Red Imported Fire Ant Control

RIFA is a major plant quarantine pest, thus *Regulation on Plant Quarantine* is the most fundamental law basis for its control. Regulation on Plant Quarantine specifies: The dangerous pests (including diseases, insects and weeds) that can spread with plants and products thereof incurred in local areas shall be categorized as the plant quarantine pests. Necessary measures should be put in place to intercept and eradicate the quarantine pests of limited distribution, and their host plants shall be subject to quarantine before transportation. Accordingly, China issued the announcement in Jan. 2005 not long after finding RIFA, and defined RIFA as quarantine pest. Meanwhile, Emergency Plan for RIFA Control is issued, followed by National RIFA Epidemic Elimination Plan, Publicity and Training Plan for RIFA Epidemic Control, China RIFA Risk Analysis Report etc. in Jun. Other relevant departments also issued the corresponding policies and regulations. General Administration of Quality

Supervision，Inspection and Quarantine (AQSIQ) issued Warning and Notification on Prevention of RIFA Introduction in Nov. 2004, State Forestry Administration (SFA) Notification on Strengthening the Quarantine and Monitoring of RIFA in Jan. 2005, and General Office of Ministry of Health Notification on Strengthening the Monitoring, Control of RIFA in Mar. 2005.

Difference provinces (cities, autonomous regions) successively issued corresponding local policies and regulations based on those of MOA. *Control Plan for RIFA Epidemic in Guangdong Province* was issued by Guangdong in Nov. 2004, followed by the emergency control plans of RIFA of Hunan, Chongqing, Guangxi, Fujian, Jiangxi, Hainan and Yunnan. Some of municipal (county) governments also prepared local control documents of RIFA, for example, Emergency Control Plan of RIFA in Meizhou City was printed and distributed by Office of Meizhou Government, Guangdong in Aug. 2005. Issuing these policies and plans turns RIFA control into the government action, as well as provides basis and guarantee to a better response and treatment of the unexpected epidemic of RIFA and other major plant pests.

China clearly defines the requirements of RIFA control policy, meanwhile, the standard system relevant to RIFA control is established for the necessary science and technology support. Seven standards has been issued so far, including *Methods for Quarantine and Identification of Red Imported Fire Ant* (GB/T 20477-2006), *Rules for Quarantine of Red Imported Fire Ant* (GB/T23634-2009), *Rules for Epidemic Monitoring of Red Imported Fire Ant* (GB/T23626-2009), *Test Criterion for Field Trial of Pesticide (II)*, Part 149: *Prevention of Red Imported Fire Ant with Pesticide* (GB/T17980.149-2009), *Technical Rules for Chemical Control of Red Imported Fire Ant* (NY/T2415-2013), *Technical Rules for Control of Red Imported Fire Ant in Nursery* (DB44/T598-2009) and *Evaluation Criterion for Control Effects of Red Imported Fire Ant* (DB44/T1323-2014). National Agro-Tech Extension & Service Center (NATESC) under MOA also prepared *Technical Scheme for Control of Red Imported Fire Ant* in 2015 for guiding the RIFA control.

3.6 VI. Gap Analysis between China and Abroad

As mentioned above, a relatively complete legal framework of pesticide registration, use and management covering efficacy, environment, toxicology and residues evaluation has been established in China. The legislation framework, though lagging behind the legal framework of developed countries in Europe and America, is in the leading level in China and other developing countries. Developed countries in Europe and America clearly define the main body of pesticide management, while the pesticide production, registration and sales are separately managed by different departments in China, easily bringing the overlapping responsibilities or supervision loopholes. The pesticide management in developed countries focuses on safety assurance. Therefore, the management system of pesticide use and business license is established in USA, and the system of pesticide users working with legal certificate is established in Germany. In addition, the system of synchronous residue limit standard preparation and registration review is established in USA, EU and Japan with 11,000, 145,000 and 58,000 pesticide residue standards respectively. However, the management system of pesticide utilization and business license is absent in China, thus the pesticide residue standard preparation falls behind the registration review

with only 3,650 pesticide residue standards so far. On the other hand, although the number of residual standards in China is smaller than that of developed countries, while 2/3 of which are stricter than or equivalent to CAC standards. In addition, in terms of the poor pesticide market supervision, very strict policy of prohibited and restricted pesticides has been implemented in China. The pesticides such as methamidophos and parathion currently used in many developing countries and even in some developed countries like USA have been prohibited in China. Some other pesticides such as fipronil and fenobucarb are restricted for use due to their environmental or toxicity risks.

There is another gap of the legal framework of pesticide management in the area of the special pesticide registration. Such a system works properly in some developed countries while the legal arrangement largely stays on paper in China. Taking New Zealand as an example, special registration was granted for some pesticides against RIFA as an emergency action soon after the pest was detected. However, owing to the low operability of legal provisions in China no pesticide against RIFA can actually be specially treated in the registration process. As a result the RIFA was first found in China in 2004 while no pesticide had been registered for RIFA control until 2009 and there are only 12 pesticide products registered as of March 2016. As for some other quarantine pests, the situation could be even worse and no registered pesticide is available so far.

As for the legal framework for RIFA control, there are gaps on the aspects of operability and implementation. There is a very effective expenditure sharing system in Australia between federal and different state governments. Although RIFA occurs in Queensland, the costs for its control are shared by federal government and the governments of Queensland and its neighboring states including New South Wales and Victoria. In china a basic principle of the legal framework is the so called “territorial management”, which means local government should play a major role in the control of RIFA. As a result the control measures stipulated in legislation cannot be properly put in place in some areas of poor financial condition. Relative legislation in China and the USA both imposes strict control on the movement of regulated articles out of the areas infested by RIFA. Owing to the difference of public awareness and enforcement supervision, the implementation of this provision in China is much poorer than that in the USA. The turf and ornamental plants should be strictly controlled in RIFA occurring areas but they are actually the major vectors of long distance spread of the pest in China.

Systematic efforts need to be taken to bridge the gaps of the legal framework of pesticide management and RIFA control in China. The State Council is now revising the *Regulation on Pesticide Administration*. This project can also contribute to narrowing the gaps. Activities can be designed to promote the special pesticide registration system and a series of public awareness raising initiatives can be taken to strengthen the enforcement of the legislation. With all these efforts, the distance of pesticide management between China and the developed countries is expected to be further narrowed after its issuing and implementation.

Chapter 4. Institutional Capacity

4.1 I. Pest Managing Agencies and System

In order to deal with the risk caused by pests to agricultural production effectively, an ideology "Public Plant Protection" was raised and more public resources are invested in pest control today in China than in the past. There are special pest managing agencies running from MOA to agricultural bureaus at county level. NATESC directly affiliated to MOA is in charge of the national organization of pest management. Plant protection stations established under all the provincial departments of agriculture, city and county agricultural bureau are responsible for the pest forecast and management locally. No special pest managing agencies are constructed at township level. However there are technicians on plant protection in township agro-tech stations who provide technical service to farmers directly. There is also a complete forest protecting system in the forestry sector. Forest protection stations established in the State Administration of Forestry, provincial departments of forestry and city and county forestry bureaus are responsible for the management of forest pests.

4.2 II. Pesticide Managing Agencies and System

1. Supervision System: A relatively complete pesticide supervision system with Institute of Pesticide Control, Plant Protection Station or Comprehensive Law Enforcement Team[3] as the main law enforcement bodies and covering central authorities, provinces, cities and counties has been established, with 17,400 front-line agricultural comprehensive law enforcement officers including more than 1,600 full-time pesticide supervisors. The pesticide supervision methods have been improved due to the plant protection project in recent years, and pesticide residue and quality monitoring centers have been established in some regions. However, the pesticide supervision is insufficient for the numerous pesticide production, operators and users. The law enforcement officers can only make 1-3 urgent inspections on most pesticide markets in towns per year, and there is still "dead zone" of daily supervision in some areas.

2. Pesticide Use and Storage Control by Government: The State Council revised and issued *Regulations on the Safety Administration of Dangerous Chemicals* in 2011, with clear definition of the use and storage of dangerous chemicals including parts of pesticides. *Regulation on Pesticide Administration* specifies: The agricultural administrative director shall be responsible for promoting and directing the safety and reasonable pesticide use. Therefore, governments at all levels actively take measures to improve the levels of safe pesticide use and storage. MOA organized the "Training Courses of Scientific Pesticide Use for 10,000 Farmer of 100 Counties" in 2015. As a result, 10,000 leading farmers participated in the courses with a diffusion impact on 100,000 peasant households. However, the pesticide use and storage safety is poor due to the low-quality operators and users. According to the market inspection of

[3]Institutes of pesticide controls specialized for pesticide supervision are established under the administrative departments in charge of agriculture in some areas, in the other areas plant protection stations or comprehensive law enforcement teams are responsible for the supervision of pesticides.

Plant Protective Station of Xi'an Shanxi, mixing storage of pesticide and non-pesticide and mixing use of working areas and living quarters generally exist, which are especially common in small and medium-size stores in districts and counties at a rate of 12.5%, causing potential security hazard.

3. Pesticide Package and Labeling: Administrative Measures for Pesticide Labels and Manuals is a part of "Six new regulations" of pesticide management. The Measures clearly define the marked content, preparation, use and management of labeling, whose requirements are basically consistent with those of *Criterion for Good Pesticide Label* of Food and Agriculture Organization (FAO). The label is one of the main items of pesticide registration review as well as one of the key market inspection objects of pesticide monitoring departments in practical work. The pesticide package and label are improved after the constant efforts. However, problems can still be found in market inspection in different regions, including absent Chinese active ingredient label or unclear label, use range expansion without authorization, unclear manufacturer information, unclear batch number, unclear manufacturer date and toxicity symbols changes without authorization.

4. Measures of Restricted Pesticide: Prohibition and restriction provisions have been issued in China in recent years. In national level, 39 pesticides with high toxicity and high residual or causing cancer, malformation and mutation, including methamidophos and fenamiphos, are prohibited to be used, and 19 pesticides with high risk, including fipronil and omethoate, are restricted to be used. In addition, more pesticides are included in the prohibition and restriction lists in some regions based on the national pesticide list. In order to guarantee the implementation of prohibition and restriction use measures, relevant departments abolish the registration certificate, production license and production approval certificate of prohibited pesticides, withdraw or suspense to handle the pesticide registration certificate of restricted pesticide used in the restricted crop, and reinforce the investigation and treatment of the illegal production, sales and use of prohibited and restricted pesticides through market inspection and field investigation in daily supervision. As a result, the prohibition and restriction measures are well implemented in most regions. However, the prohibited and restricted pesticides are still found to be illegally used in some areas (especially in individual growers) due to their low price and good control effects.

5. Supervision of Local Pesticide Use by Government: Pesticide regulator i.e. Institutes of pesticide control, plant protection stations and the comprehensive law enforcement teams make regular pesticide market inspection and pesticide quality sample inspection, focusing on the standardization of pesticide label and identification as well as the standardization and consistency of the active ingredient types and content of pesticide. In addition, pesticide regulator and quality and safety regulators of agricultural products will make regular inspection on the pesticide residue of the selling agricultural products for dynamically acquiring the local pesticide type, dosage and other use conditions.

6. Pesticide Toxicity Data Acquisition: The pesticide classification standard is prepared based on the pesticide hazard classification standard recommended by World Health Organization (WHO) as well as the practical situation of pesticide production,

use and management. In addition, Administrative Measures for Pesticide Labels and Manuals clearly defines that the graphical label and toxicity level characters shall be marked on the label. Therefore, the toxicity information can be easily acquired by the pesticide users from the pesticide label. What's more, with the popularity of the Internet in China, more and more farmers have opportunities to access the Internet and query the pesticide toxicity data online.

7. Emergency Treatment Capacity for Pesticide Poisoned Patients: The strong rural medical and health system with the town health clinics and village health rooms as main bodies has been established in rural areas. Except for the incurable pesticide cases (*e.g.* paraquat poisoning), most pesticide poisoning patients, as long as timely discovered, can be taken to the medical institutions nearby for treatment.

In conclusion, China attaches great importance to the pesticide supervision, continuously improves policies and regulations and strengthens supervision, thus safety production and use level of pesticides is improved steadily. But on the other hand, China is confronted with the common problems for developing countries, for example, insufficient law-abiding consciousness of producers, operators and users of pesticides, inadequate supervisory ability of the government. Especially China has small scale in pesticide production, operation and use and involves many subjects. Therefore, at present, China is still faced with great difficulties and challenges in pesticide supervision**.** Previous work experience and the government's high attention provide good conditions for the pesticide supervision in China. In this case, pesticide supervision level in China will be improved rapidly in a short period of time, pushed by the outside force of project of World Bank, so as to benefit the people's livelihood and environmental protection.

Improper disposal of obsolete pesticide will result in serious environmental problems, and the disposal itself also is difficult to be done with a lot of problems. The main difficulties include: 1) Waste pesticide is difficult to collect; 2) The disposal cost is very high; and 3) There are still no safe and effective disposing methods for some waste pesticide. China has been actively promoting the treatment of pesticide wastes. While strengthening the publicity and guidance, some places also provide some incentive measures and establish some government projects to promote the disposal, but the effect achieved is not satisfactory.

In the case of this project the amount of sulfluramid to be replaced by the Project is small, and its marketing channel is relatively concentrated, mainly in the way of government procurement by bidding. Thus waste pesticide is relatively easy to collect after the exemption period. The sulfluramid products from producer inventories and circulation may be retrieved by the pesticide producers themselves as the project design includes the subsidy for the production enterprise of sulfluramid to change the line of production (included in the PFOS Production Reduction component according to the overall project design). The sulfluramid products scattered in the end users can be retrieved by the method of pesticide exchange. As described in chapter 4 RIFA controlling pesticides are largely distributed to end users by village leaders. As a result, the remaining sulfluramid can be collected by village leaders when they distribute non-PFOS products. The remaining sulfluramid retrieved will be concentralizedly stored by province in a pesticide warehouse designated by the

provincial plant protection station. Those pesticides will be transported to a disposing facility certified for dangerous chemicals of HW04 category and destroyed by incineration at the end of this project.

4.3 III. Relevant Restrictive Regulations on Production and Use of Sulfluramid

Sulfluramid is a pesticide, so its production and sale require the so called "three certificates", *i.e.* Pesticide Production License, Pesticide Standard and Pesticide Registration Certificate. Besides, currently there are no other restrictive regulations on production and use of sulfluramid. According to the commitment of Chinese government to comply with Stockholm Convention on Persistent Organic Pollutants, sulfluramid used for the RIFA control will be phased out in 2019. The project will invite representatives of the relative agencies under the Ministry of Agriculture and the Ministry of Industry and Information Technology who are responsible for issuing the "three certificates" to attend a conference to discuss the procedure to rule out the production, sale and use of sulfluramid. Bearing the responsibility to implement the POPs Convention in China and facilitated by this project, relevant governmental departments will revoke the certificates of production and marketing of sulfluramid and take necessary supervision measures on the suspension of production, marketing and use thereof.

4.4 IV. Capability of the Executing Agencies for the Project

RIFA is an important quarantine pest in China, and presently it falls under the mandate of the government and led by the agricultural sector, cooperated by forestry department and botanical garden department. According to the situation, the project will be carried out by the agricultural sector, specifically the plant protection system. A National Plant Protection Organization under the Ministry of Agricultural can be picked up to be responsible for the overall design, execution and monitoring of the project with the guidance from FECO. Relevant provincial and county plant protection stations in areas infested by RIFA will be involved in conducting the demonstration and training activities in their respective areas. Meanwhile some research institutes will be selected to conduct pesticide screening.

The plant protection system is capable of execution of the project in both facilities and personnel resources. Usually every plant protection station employs a certain number of professional technicians (generally about 30 persons in every station at provincial level, 5-10 persons at city level and 3-5 persons at county level). In recent years, the working conditions of the plant protection system have been greatly improved through the implementation of "plant protection project" launched by the Ministry of Agriculture. Most plant protection stations now have laboratories, field monitoring stations, pesticide warehouses and vehicles. Taking the leading role in the control of RIFA, the plant protection stations in the areas infested by RIFA have done a lot of work to monitor the dynamics of RIFA population, select pesticides and assemble control technologies since the introduction of the pest into China. With the rich experience of fighting against RIFA, the plant protection stations are competent implementing agencies for the project.

Although the plant protection technicians are experienced in practical control of RIFA, there is little serious thinking about the strategy for elimination of sulfluramid in the

system. Moreover, sulfluramid is still recommended by the technical standard used by the system for RIFA control. For this reason, the project can support a study of the policy for the elimination of sulfluramid and facilitate the revision of the technical standard. Such a study will explore the difficulties in the elimination of sulfluramid and raise some policy recommendations in this regard. The revision of the standard will cancel all references to sulfluramid and include some other more environmental friendly alternatives.

Chapter 5. Major Control Measures of Red Imported Fire Ant

5.1 I. Existing Management Practices of Red Imported Fire Ant in China

Different natural conditions in RIFA occurring areas and harm conditions of RIFA lead to different RIFA management practices in different areas in China, but the key measures are basically the same, mainly including:

1. Survey and Monitoring

In areas where no invasion of RIFA has been reported, interviewing surveys are conducted to preliminarily determine whether there was introduction of the pest, Usually the medical personnel and residents are asked whether they know local people have ever been stung and hurt by ant, local farmers and gardeners are inquired whether they have seen raised ant nests on the ground, and local management personnel are asked whether high-risk regulated articles have been moved in from areas of RIFA occurrence in the past a few years. Based on the interviewing survey, field investigation is conducted to check whether there are suspicious mounds in the survey areas, and to observe whether there are ants which leave the nest quickly and attack the investigator aggressively. When necessary, the suspected RIFA specimen is collected for laboratory test.

In areas of RIFA occurrence, trapping method and personal inspection are used to determine the range of occurrence and dynamics of population. For trapping, the fresh ham sausage is filled as bait into a purchased or homemade monitoring bottle; the bottles are fixed on the ground in different places in the occurring area; .after certain period the bottles are retrieved and the ants trapped are collected for identification and counting. For personal inspection, a group of people stand in a row with around 2 meters apart from one another; they walk forward parallel slowly and search for ant mound carefully. In order to find all the mounds, the personal inspection is usually repeated several times. Both trapping and personal inspection are very expensive and time consuming. However it should be done carefully because the RIFA can only be well controlled when you know exactly where they are.

2. Quarantine Supervision

Quarantine supervision is an important measure for preventing the spread of RIFA by human activities, and mainly falls into the following aspects:

Inspection in Producing Areas. Inspection is regularly conducted on the plants subject to quarantine such as potted plants, nursery-grown plants, flowers and sod and in their producing sites during the growing period. It is checked whether there is

suspected RIFA on the plants and whether there are ant channels or ant nests in the soil or growing medium. The surrounding producing sites, especially waste-grassland, farmland, dam, roadside, riverside, lawn, park, school, courtyard and rubbish heaps are surveyed to check whether there are suspected RIFA and indication of its activity. When ant channel is found, one can scrape open the channel or look for ant nest along the channel and then excavate the nest using plowstaff to collect ants. If necessary, baits can be placed in checks in producing site or on the surface of regulated articles to trap the ants. The baits are inspected 30 minutes later to check whether there are suspected ants.

Inspection before Movement. Inspection is conducted on the regulated articles before they are transferred. For regulated articles such as the potted plants, nursery-grown plants, flowers, sod and soil and growing medium used, inspection is conducted to check whether there is suspected RIFA or traces of RIFA activities; when traces are identified, the soil or growing medium can be excavated with a plowstaff to check whether there is suspected RIFA inside. For the other regulated articles such as packing material and vehicles, it should be checked whether there are suspected RIFA or trace of RIFA activities on their surface; if ant channel is found one can look for suspected RIFA or ant nest along the ant channel and the suspicious articles should be unpacked for inspection. When necessary, baits can be used to trap ants.

Phytosanitary Treatment. If the regulated articles such as potted plant, nursery-grown plant, flower, turf and soil and growing media have to be moved outside of the areas infested by RIFA, they should be subject to immersing or injecting treatment with pesticides of strong contact toxicity (such as permethrin, deltamethrin, cypermethrin and fenvalerate). For potted plants, chlorpyrifos granule, fenvalerate granule and diazinon granule can also be used and scattered uniformly on the growing medium (with active ingredients accounting for 0.001~0.0025% of the media) and then irrigated thoroughly with water. For rubbish, soil and growing media, the above mentioned granules can be mixed inside, agitated and irrigated thoroughly before movement.

3. Chemical Control

At present, chemical control is a key measure for effectively controlling the RIFA in China, mainly including baiting method, mound drenching method, granules and powder-based nest elimination method, and two-phase method.

Baiting Method. Commercialized or self-prepared baits are used to treat individual ant nest or spread widely in the occurring areas. In areas of high density of nests and wide distribution of RIFA the methods of individual nest treatment and wide spreading are integrated to improve the control effect; in areas of low density of nests and sporadic distribution of RIFA baits are scattered in spots or circularly 10~50cm away from the ant nests and caution should be taken not to disturb the ant nests. For individual nest treatment, the dosage of the baits are determined according to the size of ant nest and specification of the product; ;usually the median dosage recommended is used for ant nests of diameters between 20~40cm while the ant nests of diameters less than 20cm or more than 40cm are treated with the lower and upper limits of recommended dosage respectively. For scattering use in areas of wide distribution, the rate twice the recommended dosage is usually used per 100 m^2. The control effect is

evaluated and baits can be supplemented in areas where there are remaining live nests with the dosage of individual nest treatment or in areas where worker ants are trapped with the lower limit of the recommended dosage.

The baiting method is designed based on the social feature of RIFA and the whole nest can be eradicated through the social activities of ants such as grooming and trophallaxis. To achieve that unique mechanism of action, the bait should meet the following requirements: (1) Broad effective dosage which ensures the pesticide is still lethal to RIFA when greatly diluted after transmission between ants through trophallaxis; (2) Slow action of lethality which allows the worker ants to survive for some time after intoxication to transmit pesticide to other ants; (3)no antifeedant property which doesn't result into antifeeding activity by worker ants. It is not easy to meet all those requirements and there are only 11 bating products of 7 active ingredients are available in China as of March 2016 (see chapter 5 for details).

Mound Drenching Method. Pesticides of strong contact toxicity such as pyrethroids, organophosphorates and carbamates are prepared as dilutions of specific concentration according to the product specification. The liquid pesticide is first applied in a circular belt 25~30cm wide in the periphery of the ant nest and then directly irrigated on the mound or in the middle of the ant nest after excavating its top. The application should be conducted very fast and the pesticide should uniformly penetrate the nest deeply up to 1 meter to prevent the escape of the RIFA. Usually 10~20 l of dilution is applied to an individual nest and the dosage should be proportionally increased for ant nests of bigger size. This method is applicable to the occurring areas where there are obvious live ant nests and the RIFA causes threat to human health or important facilities which necessitates emergency control. It is not suitable for general use since the RIFAs can usually transfer the queen ant from the drenched nest and establish a new nest in neighboring area.

Granule and Powder-based Nest Elimination Method. The granule or powder of pesticides of quick contact toxicity such as pyrethroids, organophosphorates and carbamates are scattered on the nests and in neighboring areas. Water should be sprinkled immediately after the application and then once every 2~3 days up to more than 3 times in total. Determine the dosage according to the commodity instructions. The dosage is determined according to the product specification and nest size. Usually the median dosage recommended is used for the ant nests of diametersbetween20~40cmwhile the lower and upper limit of the recommended dosage are used for the nests below or above that diameter range. This method is applicable to occurring areas of obvious ant nest. If suitable pesticides (*e.g.* slow action) are chosen the whole nest can be eradicated through the contact between ants. However the granule and powder are easier to formulate and produce but more time consuming to apply as compared to the baits.

Two-phase Method. This method consists of pesticide applications in two phases. For the first phase, the baits are applied in different ways according to local circumstance of RIFA occurrence as described in the above paragraph of baiting method. For the second phase, granule, power or bait is applied to live ant nests 10~14 days after the first phase later based on an effect evaluation. With the continuous control efforts of two phases and the targeted application of pesticides in

the second phase, this method can produce improved effect and result into a reduction of pesticides, and is now recommended in China for large scale use.

5.2 II. Current Training and Services

1. Training Events

Some training courses have been delivered on the control of RIFA in China since the introduction of the pest. The trainees included staff members of plant protection stations and the end users of pesticides including farmers and city residents. This kind of training is far from adequacy in two aspects. On one hand the coverage of the training is much limited and only some employees of plant protection stations and very few end users had the changes to participate. On the other hand because RIFA is a new pest in China the information disseminated in the training was not always right. The drenching method was once recommended for general use in some areas. However the effect of this method is not good enough because the RIFA could be driven to flee the drenched nests. In view of the fact that RIFA control is led by the government and the pesticides required is mainly centrally purchased from pesticide producers, there is basically no trainings for pesticide retailers.

2. Public Awareness Events

Some initiatives have also been take with the aim to raise public awareness. Report of the damage of RIFA can be found in some newspapers or TV programs and posters on the control of RIFA were distributed in some areas. However owing to the same constraints as the training events, the impact of propaganda campaign is much limited and the RIFA and the right way to control the pest remain unknown to many people up to now. As a result when farmers in areas recently reported to be infested by RIFA are interviewed, they could answer they had noted the presence of the ants for quite some time without knowing they are RIFAs.

The deficiency of training and public awareness raising in China have resulted into great difficulties in the control of RIFA. Some end users don’t know how to apply pesticides properly, some others don’t use the pesticides distributed by the government at all. Addressing this deficiency capacity building should be incorporated as major components of this project. Large scale training will be conducted to cover major players in the control of RIFA including employees in relevant agencies and key contact persons of the end use and various means such as TV program, posters and popular books on RIFA control should be taken to disseminate the knowledge of the pests (see chapter 7 for details).

5.3 III. Measures and Methods of RIFA Control Tested but not Successfully Established

Over the past 10 years, some measures and methods have been tested but not successfully established in China which can largely be categorized into 2 groups.

1. Pesticide Development

In addition to the 12 products with 7 active ingredients registered as of March 2016 (see chapter 5 for details), another 31formulated pesticides have been developed by 24 enterprises (institutes) but failed to turn out to be registered products. Those

formulations include 28 baits and 3 powders with abamectin, tetramethrin, fenoxycarb, pyriproxyfen, imidacloprid, propoxur, chlorpyrifos, spinosad, hydramethylnon, sulfluramid, fipronil, NBPOS, hexaflumuron, N-butyl perfluorooctane sulfonamide (N-BPS), cypermethrin, boric acid indoxacarb and rotenone as active ingredients. Except 5 with sulfluramid as the active ingredient, there are 26 non-PFOS formulated pesticides among which some have been preliminarily proven to have effect on RIFA control and hence could be potential replacements for sulfluramid in RIFA control. The reason why those development processes didn't come up with registered products varied in different cases among which the thinking of cost-effectiveness is a major one. The occurring area for RIFA is much smaller as compared to ordinary pests of field crops, which means the demand and hence the market for pesticides against RIFA is small. Therefore many companies (institutes) are not willing to spend time and money registering pesticides for RIFA control.

2. Biological Control

Continuous efforts have been taken to develop biological control measure against RIFA. Some substances were extracted from different plants such as *Derris* genus, *Tripterygium wilfordii*, *Excoecaria cochinchinensis*, *Lantana camara*, *Nerium indicum*, *Thevetia peruviana*, *Allemanda neriifoliaetc.* and tested for their effect on controlling RIFA.The pathogenicity of fungi including *Beauveria bassiana*, *Matarhizium anisopliae* and *Metarhizium flavoviride* were also studied. However those efforts were limited in laboratory experiment and no commercial products are available up to now.

5.4 IV. Methods of RIFA Control Available Outside of Mainland China

RIFA firstly occurs in Brazil and Argentina of South America and now has spread in nearly 20 countries and regions including China, United States, Australia and New Zealand. In addition to the methods used in mainland China, some other methods have been developed in other countries and regions in their long fight against RIFA.

1. Physical Control

Burning Method: Fire is used for burning the RIFA growing lands overgrown with weeds to directly burn RIFA to death. As RIFA is humicolous insect, the burning method can only kill part of RIFA outside the nest and is thereby only used as an assistant measure before destroying the RIFA breeding place (including derelict land) overgrown with weeds in a large scale.

Boiled Water Method: The boiled water is directly poured into the ant nest for 1-2 weeks in succession. Although such method has less influence on the environment, the killing-effect is low. It only can be used as a temporary emergency method for small groups of ants in houses and homes, which need to be prevented and controlled without using the chemical pesticide.

Flooding Method: The whole ant nest is dug out to be placed in the bucket full of detergents for more than 24h. Such method is only applicable to visible anthills and is useless for new nests without anthills or ant nests with inconspicuous ground feature of anthills. In addition, it has low efficiency, unable to solve the regions with larger hazard area.

Freezing and Killing at Ultralow Temperature: Such method is proposed by researchers in Taiwan, China. The liquid nitrogen is injected in the ant nest to directly freeze RIFA in the ant nest to death. The liquid nitrogen is taken from the liquefied air without the chemical agents to pollute the soil. It is not affected by the weather with quick killing effect, but it is high in the cost and only for separate mound, lacking actual application value.

2. Chemical Control

Fumigation Method: The fumigation agent such as methyl bromide or aluminum phosphide is used for fumigation. Such a method is mainly used for quarantine treatment of various mediums possibly carrying RIFA with no massive value of use.

3. Biological Control

A lot of biological control measures have been studied and some have been put into practical use worldwide. Research has been done in USA on natural enemies against RIFA includingfungi (*e.g. Thelohania solenopsae* and *Beauveria bassiana*), nematodes (*e.g. Steinernema* spp. and *Heterorhabditis* spp) and parasitic insects (*e.g. Pseudacteon* spp., *Orasema* spp., *Lipolexis scutellaris*, *Caenocholax fenyesi* and *Solenopsis dagerrei*). In 2002, United States Department of Agriculture (USDA) built up facilities to breed phorids (*Pseudacteon* spp.) in Florida. Four species of phorids introduced from South America were bred in industrial way and released into the natural environment with large quantity. About 20%~30% RIFA were controlled by phorid. A pathogenic fungus *Beauveria bassiana* has been registered for RIFA control in USA. It is formulated as capsules with mixed fungi and food stuff inside. When the capsules are carried by worker ants into nests, the fungi are released gradually to kill RIFA.

For those methods used both in mainland China and outside, experience can also be drawn from other countries and regions. A lot of pesticides have been tested against RIFA in USA and Australia and hence many more registered products are available as baits, granules and powders. Taking baits as an example, more than 700 formulated pesticides have been tested and those commonly used include fipronil, indoxacarb, pyriproxyfen, spinosad, hydramethylnon, fenoxycarb, abamectin, deltamethrin, chlorpyrifos, acephate, carbaryl, methoprene and boric acid. Two-phase method is widely used in USA and Australia and proven to be very effective. According to a study in Australia, no nest of RIFA was found in98% of the treated areas after the two-phase method was applied.

5.5 V. Evaluation of Current Pest Management Methods and Analysis of Gap

As previously mentioned, there have been many RIFA control methods used in China, many of which do not comply with IPM principle, and there is a broad gap between mainland China and outside.

1. There are fewer choices of RIFA control methods in China. Currently large scale control has to rely on chemical pesticides with no other integrated control measures available. Some biological control agents such as Phorid and *Beauveria bassiana* have been put into practical use in USA to control RIFA while the work on biological control is still limited to experiment in laboratories in China.

2. Only a few chemical pesticides can be used for RIFA control in China. There are a large number of product choices in other countries but most of those pesticides have not been registered and hence cannot be legally used in China.

3. Owing to deficiency of training and public awareness raising, some control methods currently used in China perform badly with severe environmental pollutions. For example, mound drenching method is widely used at the initial stage of occurrence of RIFA and still applied in some places nowadays. As described earlier in this chapter, this method cannot achieve the goal of eradication have apparently negative impact on the environment due to large dosage of pesticides used.

The control of RIFA in this project shall comply with the principles of integrated pest management embodied in the World Bank Operational Policy OP 4.09. Taking into consideration the reality that there are no practicable agricultural, physic and biological control methods in China, the project shall promote the use of more effective and environment friendly control method. The two-phase method shall be applied in demonstration areas and the efficacious and more environmentally friendly alternative insecticides shall be extended to attain dual goals of successful phase-out of sulfluramid and sustainable control of RIFA. In addition to effective control of RIFA in the project areas during the project period, effort shall also be taken to develop new control approaches in order to improve the sustainable management of RIFA in China in the long run:

The first is to conduct a series of training and awareness raising activities including preparing and releasing TV program, posters and popular books. With this effort, it is expected that the correct understanding about RIFA and the right approach to control it are disseminated and stronger support from various players can be attained.

The second is to screen the control pesticides and test their effect under the project. Meanwhile, studies shall be conducted on the registration policy of pesticides against quarantine pests to facilitate the registration of good products.

Chapter 6. Use and Management of Pesticides

6.1 I. Current Situation of Pesticide Use

There have been 7 kinds of active ingredients and 12 types of formulated pesticide products registered for RIFA control in China (see table 1). Among the active ingredients, only spinosad belongs to WHO class III (slightly hazardous) and all the others including hydramethylnon, Sulfluramid, fipronil, alpha-cypermethrin, indoxacarb and imidaclopridare classified as class II (moderately hazardous). The products are mainly formulated as baits (11 types) with the rest one as powder. Among the baits two products have sulfluramid as active ingredient or one of the active ingredients, three have fipronil as active ingredient or one of the active ingredients, two have hydramethylnon and indoxacarbas active ingredient respectively, and one has spinosad and imidacloprid respectively as active ingredient. Alpha-cypermethrinis used as the active ingredient in the only one powder.

Table 1. Types of Pesticides Registered for RIFA Control

(As of March 2016)

SN	Company name	Active ingredientsand content	Pesticide registration certificate number and expiry date	Type	Method of application	Toxicity grading of active ingredient (WHO)
1	BASF SE	0.73% hydramethylnon	WP20140140 2014.06.17 -2019.06.17	Ant killing baits	25-50g for each ant nest in case of small density; 1kg/ha. plus 25g for each ant nest in case of large density.	II
2	Guangdong LuodingYong'an Chemical Co., Ltd.	1% Sulfluramid	WL20140021 2015.09.02 -2016.09.02	Ant killing baits	10g/nest, circularly applied near the anthills for single ant nest. Add the dosage for large anthills. For large occurring areas of RIFA, 22.5kg/ha., applied in large area in combination with application on single ant nest.	II
3	Guangdong Zhuhai SEZ Ruinong Plant Protection Technology Co. Ltd.	0.015% spinosad	WP20140049 2014.03.06 -2019.03.06	Ant killing baits	20-30g/nest, circularly applied near the nest.	III
4	Guangdong FoshanBrightMartCropscience Co., Ltd.	0.5% sulfluramid + 0.05% fipronil	WL20140031 2015.11.27 -2016.11.27	Ant killing baits	Applied at the place where RIFA often appear. Immediately and additionally applied once the baits are ate by the RIFA.	II
5	Guangdong Foshan Bright Mart Crop science Co., Ltd.	0.05% fipronil	WP20130217 2013.10.24 -2018.10.24	Ant killing baits	Applied at the place where RIFA often appear. Immediately and additionally applied once the baits are ate by the RIFA.	II
6	Guangxi Liuzhou Wanyou Domestic Public Health Pest Control Institute	0.3% fipronil	WL20150001 2016.01.15 -2017.01.15	Ant killing baits	15-20g/nest, circularly applied near the nest.	II
7	Wuhan Chuqiang Biotechnology Co., Ltd.	1% hydramethylnon	WP20140238 2014.11.15 -2019.11.15	Ant killing baits	15-20g/nest, applied at the place where RIFA often appear. Secondary control and supplementary application 1-2 months	II

SN	Company name	Active ingredientsand content	Pesticide registration certificate number and expiry date	Type	Method of application	Toxicity grading of active ingredient (WHO)
					later according to the occurrence of RIFA.	
8	Anhui Xifengshou Agricultural Science & Technology Co., Ltd.	0.1% alpha-cypermethrin	WP20090235 2014.04.16 -2019.04.16	Insecticide powder	Directly and evenly applied at the place where the RIFA often appear.	II
9	Anhui Xifengshou Agricultural Science &Technology Co., Ltd.	0.1% indoxacarb	WP20140218 2014.08.27 -2019.08.27	Ant killing baits	Evenly applied 50-100cm within the ant nests. Reapplied in case of rain within 2 days after the application.	II
10	Guangdong Guangzhou Zhongda Biological Engineering Co., Ltd.	0.05% fipronil	WP20150202 2015.09.23 -2020.09.23	Ant killing baits	5-10g/nest, circularly applied near the nest.	II
11	Anhui Kangyu Biological Technics Project Co., Ltd.	2.15% imidacloprid	WP20100020 2015.01.14 -2020.01.14	Insecticide bait formulation	20-30g/nest, circularly applied near the nest.	II
12	Anhui Kangyu Biological Technics Project Co., Ltd.	0.05% indoxacarb	WP20160024 2016.02.29 -2021.02.28	Ant killing baits	15-25g/nest, circularly applied near the nest.	II

6.2 II. Types and Quantities of Pesticide Funded by the Project

By comprehensive comparison of technical and economic characteristics of current registered 12 kinds of pesticide (see table 2), we found that sulfluramid formulation provides good control effect, long period of preserving and comparatively cheap price. As for sulfluramid alternatives, the first choice is 0.1% and 0.05% indoxacarb bait which have the same effect, followed by 0.1% alpha-cypermethrin killing ant powder with high efficiency and 1% hydramethylnon bait successively. For other pesticides, 0.73% hydramethylnon bait, 0.015% spinosad bait and 2.15% imidacloprid bait are not the ideal alternatives for the reasons of higher costs or common effects. As for fipronil, although the product has quite good efficacy, it is highly toxic for shellfish aquatic organisms and bees and since April 1, 2009, China has restricted the use of it to the control of public health pests and dressing of some dry land seeds such as corn seeds. For this reason, the use of pesticides based on fipronil as the active ingredient is largely restricted so that those pesticides shall not be funded by the project.

As for the toxicity of pesticides, the active ingredients of the recommended alternatives (indoxacarb, alpha-cypermethrin and hydramethylnonare) are all moderately hazardous (class II as in table 1). Taking into consideration the facts that the formulated products are of slightly hazardous (Class III as in table 2)，they have been registered in many countries for RIFA control, cypermethrin and hydramethylnon have been recommended by WHO as hygienic insecticides for indoor use[4] and we don't have other options in China, it is proposed to include those 3 pesticides into the project funding. Meanwhile strict measures shall be taken to strengthen the management of transportation, storage and application so that the environment risk can be well controlled.

[4] See WHO/CDS/NTD/WHOPES/GCDPP/2006.1. The toxicity of indoxacarb is lower than that of alpha-cypermethrin but the former was not included in the recommended list. A possible explanation is that the list was published by WHO in 2006 while indoxacarb was later commercialized in 2009.

Table 2. Analysis of Technical and Economic Characteristics of Registered Pesticide Used for the Control of RIFAs in China

SN	Types of Pesticide	Technical Characteristics	Control Cost	Policy Constraints	Toxicity grading of formulation	Comprehensive Evaluation
1	1% sulfluramid killing ant bait	Good effect, fast acting and long period of lasting validity	Medium	Null[5]	III	Excellent
2	0.1% indoxacarb killing ant bait	Good effect, fast acting and comparatively long period of lasting validity	Medium	Null	III	Excellent
3	0.05% indoxacarb killing worm bait	Good effect, fast acting and comparatively long period of lasting validity	Medium	Null	III	Excellent
4	0.1% alpha-cypermethrin killing ant powder with high efficiency	Good effect, fast acting and long period of lasting validity Applicable in some areas	Low	Null	III	Better
5	1% hydramethylnon killing ant bait	Good effect, slow acting and long period of lasting validity	Medium	Null	III	Good
6	0.73% hydramethylnon killing ant bait	Good effect, slow acting and long period of lasting validity	High	Null	III	Good
7	0.015% spinosad	Common effect, comparatively fast acting and unstable	Medium	Null	III	Medium
8	2.15% imidacloprid bait	Common effect and slow acting	Medium	Null	III	Medium
9	0.05% fipronil killing ant bait	Good effect and fast acting	Medium	Prohibited and restricted	III	Medium
10	0.05% fipronil plus 0.5% sulfluramid killing ant bait	Good effect, fast acting and long period of lasting validity	Medium	Prohibited and restricted	III	Medium
11	0.3% fipronil killing ant bait	Good effect and fast acting	Medium	Prohibited and restricted	III	Medium

In comprehensive consideration of current alternative pesticides and control methods of RIFAs, the demonstrative area shall adopt the two-phase method combining 0.1% and 0.05% indoxacarb bait and 0.1% alpha-cypermethrin powder together and reapply 1% hydramethylnon bait to the ant nest left after the treatment. It can either guarantee the effects of control, or delay the possible resistance to drugs arising from repeated use of indoxacarb bait to some extent. Assume that 8 demonstrative

[5] Currently there is no policy constraint on the production and use of sulfluramid. According to China's commitment to adopt the POPs Convention, the production and use of sulfluramind will have to pause when the exemption period expires in 2019.

areas will be built under the project (see Chapter 6), each demonstrative area will cover an area of 500 Mu (666.7 m^2) averagely with 20 ant nests per Mu, then the calculation turns out that almost 6 tons of 0.1% and 0.05% indoxacarb bait and 3 tons of 0.1% alpha-cypermethrin powder will be required in total in 4 years. 1% hydramethylnon is only used for supplementary application, so only small amount is required. At present, almost 30 tons of indoxacarb bait and alpha-cypermethrin powder each are used to control RIFAs every year in China. These two active ingredients are widely used in the control of ordinary plant pests with large volume and market turnover. It is predicted that the project procurement will not influence the pesticide market significantly.

6.3 III. Risk Control of Target Environment and End Users of Pesticides

Indoxacarb, alpha-cypermethrin and hydramethylnonare all of certain environment risk and alpha-cypermethrin is especially toxic to aquatic organisms (see table 3). If these products are used in areas unsuitable or rinsed into water bodies in rainy days, or overused to leave a lot of ground residue they will have negative impact on aquatic organisms. In order to avoid such negative impact on local ecological system, the project shall be placed in areas distant from water sources[6] and the pesticides shall be applied in fine days. The RIFA is usually well targeted by pesticides and hence there is a low risk of drifting and inhalation by applicators. However if the pesticides are handled improperly, e.g. accidental inhalation or splashing on eyes, they will hurt the end users. In order to protect the health of end users, the project shall employ professional pest control organizations to apply the pesticides and the practice of the pesticide application shall be guided and supervised by local plant protection technicians so that the applicators are well protected by protective equipment and the correct procedures are strictly followed.

Table 3. Possible Environmental Risk Arising from Pesticide Supported by the Project

Names of Pesticide	Environmental Risk
Indoxacarb	Prohibited in silkworm rooms and around; prohibited in the areas nearby aquaculture areas, rivers and ponds, etc. and prohibit cleaning spraying apparatus in rivers and ponds, etc.; prohibited in the bird sanctuary; prohibited in areas of honey production or areas with crops that require pollination.
Alpha-cypermethrin	It is highly toxic for fish, silkworm and bees and shall not be used in the silkworm rooms and around. Pollution to the source of water and ponds, etc. shall be avoided.
Hydramethylnon	Do not wash spraying apparatus in ponds and gutterways. Prohibited in the areas nearby the bird sanctuary, silkworm rooms and mulberry fields.

6.4 IV. Control of Risk during the Transportation, Storage and Distribution

The baits of indoxacarb and hydramethylnonand powder of alpha-cypermethrin supported by this project are relatively safe in the process of transportation, storage, and distribution. However, certain risks may occur due to improper handling, mainly including:

1. Risk of fire. The alpha-cypermethrin is inflammable and hence shall be kept away from fire.

[6] In other countries such as USA and Australia, juvenile hormone analogues such as fenoxycarb and pyriproxyfen are recommended for use in areas near water resource. However no pesticide of this type has been registered for use in China. For this reason it is expected pesticide screening and policy research supported by this project can promote the registration of pesticides of this type. The registered product with spinosad as active ingredient is slightly toxic to aquatic organisms and hence can be used in areas near water source. It is also expected that more effective formulated spinosad product can be screened out with the support of this project.

2. Risk of intoxication. All the three pesticides are of moderate toxicity. If they are eaten by mistake or food and drinking water are contaminated, there will be poisoning cases. For this reason the pesticide shall be kept away from food during transportation, storage and distribution, and especially outside of the reach of children.

3. Risk of losing effect. The pesticides will lose effect if dampened or long exposed to sunshine. And hence the pesticides shall be stored in dry and cool environment. The oily lure contained in baits is easy to spoil and become rancid. If the package of pesticides are opened and baits inside are not used up in short time they will lose effect.

In order to prevent the risks above mentioned and guarantee all the safety instructions are well followed the project shall take the following measures during transportation, storage and distribution:

1. Pesticides should be centrally procured by open bidding. Qualification of suppliers and conditions for transportation shall be clearly specified In the bidding documents so that the hidden risk in the transportation can be well avoided. It is proposed that the pesticides to be used in this project be procured by the FECO PMO.

2. Pesticides should be transported centrally. It is required that every supplier shall transport the pesticides procured from his company for whole year use centrally and directly to every project county so that the hidden risk of transportation, loading and unloading can be controlled.

3. Pesticides should be stored safely. Safe storage shall be set as a precondition for selection of project counties and the plant protection stations of the project counties must have qualified facilities for pesticide storage.

4. Pesticides should be used in a timely manner. Clear information on the risk of losing effect should be conveyed to pesticide operators and urge them to plan pesticide use carefully and use up the pesticides within a reasonable time period after the package is opened. If some pesticides cannot be used up after package opening, the pesticides should be sealed up for short storage.

6.5 V. Popularization and Extension of Risk Mitigating Measures of Pesticides

In addition to the assurance of the safe use of pesticides in the demonstration areas the project shall take effort to popularize and extend the risk mitigating measures to improve the overall safe use of pesticides in China. Currently the pesticides of RIFA control are mainly based on government allotment in China. Grassroots government staff and village leaders are responsible for dispensing. They have chances to face end users of pesticide directly. If the process of dispensing can be turned into the process of spreading control knowledge, various possible risks arising from the use of pesticide will be treated well. Therefore, in the chain of risk control, the key is to train grassroots government staff and village leaders. Training them is the important content of the project. Well-designed training courses covering key technologies of control and safety notice are the effective measures to deal with pesticide use risks.

Chapter 7. Project Activities

In view of various issues existing in RIFA control and the process of sulfluramid phase-out in China, the project will conduct a series of activities to reduce the use of sulfluramid and promote the construction of an improved management system of RIFA control.

7.1 I. Area of Reduction of Sulfluramid Use

1. Demonstration of Alternatives

Demonstration areas are established in 5 provinces including Guangdong, Fujian, Guangxi, Hainan and Yunnan where the two-phase method without the use of sulfluramid will principally be

demonstrated. Those 5 provinces are chosen because of wide distribution of RIFA and large share of sulfluramid use. Many factors including RIFA type (monogyne and polygyne), habitat condition (*e.g.* arable land or wild land), soil type and climate (*e.g*. temperature and rain) may affect the effect of control measures of RIFA, demonstrations should be placed in different areas in multiple years to demonstrate the effective control under different conditions. For that purpose 2 demonstration areas in Guangdong, Fujian and Guangxi respectively and 1 in Hainan and Yunnan each with an individual acreage of 500 Mu will be established every year and the demonstration will be conducted for 4 years in different areas to achieve wider coverage and better diffusion effect. Two phase method will be demonstrated in those areas and the demonstration will be used as a platform for technical training.

The demonstration in different provinces will be coordinated by the plant protection organization under the Ministry of Agriculture. In respective provinces, provincial plant protection stations will be responsible for the demonstration with support from local county plant protection stations. In order to keep the demonstration on the right track, the project will organize annual meeting and prepare implementation plans every year to set clear the procedure and requirement for the demonstration.

The total budget is 2,734,000 US dollars among which 1 168,000 US dollars need to be provided by GEF.

2. Public Awareness Raising

It is scheduled to record a TV film *Damage and Control of Red Imperted Fire Ant* and have it broadcasted by the country TV stations in all the TIFA occurring areas, to develop and print posters *Recognition of Red Imported Fire Ant, Control of Red Imported Fire Ant* and a book *Questions and Answers about the Control of Red Imported Fire Ant* with a distribution to all the counties in RIFA areas, to develop and maintain a website titled as *Project on the RIFA Control and Phase-out of PFOS Substance*.

The total budget is 1,013,125 US dollars among which 225,110 US dollars need to be provided by GEF.

7.2 II. Area of Improvement of Regulatory Framework

1. Conduction of a Series of Workshops

1.1 Workshop on the control of RIFA and phase-out of sulfluramid. Governmental officials, relevant experts, competent personnel involved on the procurement of control material and organization of control implementation will be invited to sit together to discuss new development of RIFA control technologies, strategy to phase out sulfluramid and necessary supportive policy.

The total budget is 84,400 US dollars among which 29,000 US dollars need to be provided by GEF.

1.2 Workshop on enhancement of pesticide supervising capacity. Officials from the pesticide managing system and relevant experts will be invited to sit together to explore the difficulties in the pesticide supervision and possible solutions and to draw up some policy suggestions.

The total budget is 45,200 US dollars among which 15,000 US dollars need to be provided by GEF.

2. Screening of Alternative Pesticides

As described in previous chapters, there are only a few formulated pesticides available in China for RIFA control. If no more alternatives are developed risk of resistance of RIFA to the existing products will accumulate by repeated use. In order to achieve sustainable control of RIFA and avoid the comeback of sulfluramid owing to the reduced efficacy of the existing products, it is important to find out new effective alternative pesticides. As a result, it is proposed to conduct indoors screening for 1 year first, followed by field tests for 2 years, and finally based on the results of the

field tests to conduct experiment for registration for another 1 year. It is expected that the registration of pesticides for RIFA control will be facilitated with all those efforts.

The total budget is 393,020 US dollars among which 275,440 US dollars need to be provided by GEF.

3. Development of BAT/REP Guidelines

It is scheduled to develop *Technical Guidelines on the Control of Red Imported Fire Ant* and *Recommend List of Pesticides for the Control of Red Imported Fire Ant and Their Methods of Use* which will be issued in the form of official documents for implementation country wide.

The total budget is 120,460 US dollars among which 43,380 US dollars need to be provided by GEF.

4. Built-up of National Capacity

4.1 Amendment of *Rules for Chemical Control Technologies of RIFA.* It is scheduled to revise the agricultural industry standard, delete the contents on PFOS pesticide sulfluramid and add other applicable new pesticide and technologies.

The total budget is 49,160 US dollars among which 20,940 US dollars need to be provided by GEF.

4.2 Comparative study of the requirement for registration of pesticides used for RIFA control. It is scheduled to conduct such a study to explore policy proposals for improving the registration of pesticides against quarantine pests and help find solutions to the conundrum of no pesticide available in this area.

The total budget is 78,800 US dollars among which 25,700 US dollars need to be provided by GEF.

4.3 Study of the supportive policy for phasing-out of sulfluramid. It is expected to through this study to identify possible difficulties and corresponding solutions, to raise proposals for supportive policy and measures to safeguard successful substitution of sulfluramid. The implementing personnel of previous pesticide phasing-out project on Chlordane and Mirex for termite control will be invited to join in the study so that experience and lessons can be learned for this project.

The total budget is 78,800 US dollars among which 25,700 US dollars need to be provided by GEF.

5. Training

5.1 Training Methods

Training is under the direct charge of FECO PMO. The method of roll-down training will be used to conduct training courses covering all the RIFA occurring areas. First of all 35 first grade training courses will be concentralizedly conducted linking with the demonstration areas to train 1750 people responsible for the organization of RIFA control at provincial, city and county levels. Then 753 second grade training courses will be decentralizedly conducted in different counties of RIFA occurrence with 37,650 township officials and village leaders as participants in the 5 demonstration provinces.

5.2 Training Contents

The training mainly contains the followings:

- Relevant national and local laws and regulations;
- Planning and implementation of integrated management of plant pests in this Project;
- Recognition features, harm situations and control technologies of RIFAs;
- Effect features and use notice of RIFAs control pesticides.
- Environmental risk of sulfluramid.

5.3 Training Goal

Training covers all the staff from control organizations and personnel in charge of implementation in RIFA occurring areas so that they will be familiar with relevant policies and control technologies of RIFAs, realize sulfluramid alternatives and promote continuous and effective control of them as well.

5.4 Training Budget

The total budget for training is 15,716,710 US dollars among which 567,700 US dollars need to be provided by GEF.

Table 4. The Training Plan and Budget Sheet

Organizer	Training Location	Grade	No. of Trainees	Time Arrangement	Expenditures (US dollars)
FECO	Guangdong	First grade	600	12 courses conducted in 4 years from the 1st year of the project	totally 352,920 with 194,640 from GEF
		Second grade	16,000	320 courses conducted in 3 years from the 2nd year of the project	totally 6,220,400 and all provided by counterpart funds
	Fujian	First grade	200	4 courses conducted in 4 years from the 1st year of the project	totally 117,640 with 64,880 from GEF
		Second grade	5,000	100 courses conducted in 3 years from the 2nd year of the project	totally 1,927,000 and all provided by counterpart funds
	Guangxi	First grade	350	7 courses conducted in 4 years from the 1st year of the project	totally 205,870 with 113,540 from GEF
		Second grade	8,100	62 courses conducted in 3 years from the 2nd year of the project	totally 3,139,440 and all provided by counterpart funds
	Hainan	First grade	100	2 courses conducted in 2 years from the 1st year of the project	totally 58,820 with 32,440 from GEF
		Second grade	1,800	36 courses conducted in 3 years from the 2nd year of the project	totally 695,820 and all provided by counterpart funds
	Yunnan	First grade	300	6 courses conducted in 4 years from the 1st year of the project	totally 176,460 with 97,320 from GEF
		Second grade	6,750	135 courses conducted in 3 years from the 2nd year of the project	totally 2,624,700 and all provided by counterpart funds
	Non demonstrative provinces of RIFA occurrence	First grade	200	4 courses conducted in 4 years from the 1st year of the project	totally 197,640 with 64,880 from GEF

Chapter 8. Supervision and Evaluation

8.1 I. Management Organization and Duties

The overall project is managed by the project management office set up in Foreign Economic Cooperation Office (FECO) under the Ministry of Environmental Protection. The training will be organized by FECO directly with the support from a national plant protection organization under the Ministry of Agriculture. All the other activities will be packaged and contracted to the national plant protection organization. The provincial plant protection stations in Guangdong, Guangxi, Fujian, Hainan and Yunnan and relevant county plant protection stations will be involved in project implementation by sub-contract with the national plant protection organization. The national plant

protection organization is responsible for giving guidance to the plant protection system and the plant protection stations at different levels all have necessary human resource, facilities and some projects in the control of RIFA. It is expected this kind arrangement can take advantage of the current management system of RIFA control and create a resonance between this project and other projects from Chinese governments at different levels.

Project management offices are responsible for comprehensive management of the project, such as the examination and approval of the annual implementation scheme and project expenses and also the supervision of project implementation.

National plant protection organization subordinate to MOA are responsible for coordinating project implementation nationally; drawing up nationwide implementation plans, organizing kick-off and summary meeting, completing nationwide work summaries, and undertaking the capacity building and also the supervision of project implementation cooperated with project management offices.

Relevant provincial plant protection and quarantine stations undertake demonstrative area construction and the supervision of project implementation in their respective provinces cooperated with national plant protection organization..

In order to smoothly boost this project and get good effects, we shall investigate the following performance indicator:

1. Progress indicator. We shall promote the work in accordance with the time schedule stipulated in the project scheme.

2. Quantity indicator. We shall satisfy such quantity indicators set by the project scheme as numbers and areas of demonstrative regions and numbers of training courses and trainees.

3. Quality indicator. We shall guarantee the project implementation effect. For example, we can organize necessary tests after the training.

4. Comprehensive indicator. We shall promote sulfluramid alternatives and realize the sustainable management of RIFAs so that decrease rates of active ant nests and worker ants in demonstrative areas will achieve over 90%. Abilities of government departments shall be improved obviously, including organizing ability for RIFA control, decision-making ability for pest management, and also supervision and management ability for pesticide.

The total budget is 906,175 US dollars among which 371,620 US dollars need to be provided by GEF.

II. Monitoring and Evaluation

The national plant protection organization and relevant provincial plant protection stations should designate competent persons for monitoring and evaluation and provide them with necessary training. Every year the national plant protection organization should prepare an evaluation scheme which makes clear the monitoring methods, procedures and evaluation criteria. The monitoring persons and some invited experts will be sent to project areas to evaluate through observing, interviewing and document checking. The evaluation should be regularly summarized and reported to FECO for further evaluation. The total budget is 246,185 US dollars among which 99,940 US dollars need to be provided by GEF.

Individual experts will be employed to join in the implementation guidance and supervision. At nation level 1 national coordinator, 1 expert on capacity building, 1 expert on RIFA control technology and 1 expert on evaluation will be employed. At provincial level 1 provincial guiding expert will be hired respectively for 5 demonstrative provinces including Guangdong, Fujian, Guangxi, Hainan and Yunnan. The total budget is 505,000 US dollars and all need to be provided by GEF.

Annex 5: TOR of the PFOS application on the firefighting industry

With good thermal stability, chemical stability and compatibility, PFOS is widely used in film-forming foam concentrates (AFFF) to reduce surface tension of foam and improve fluidity and lipophobicity of foam. Use of PFOS-contained fire-extinguishing foam is allowed by Stockholm Convention, but phase-out of PFOS-contained fire-extinguishing foam except for special purposes is the trend in the world.

Survey results show that there are totally 61 fire-extinguishing foam producers in China. There are two major types of substitutes in substitution of PFOS-contained fluorine surfactants. The first type is non-PFOS-based short-carbon fluorine surfactants, e.g. C6 telomer. The second type is fluoride-free foams, such as the silicon-based surfactants and hydrocarbon surfactants which are usually used in combination with fluorine surfactants, the composite surfactants which are usually used for forest, high-expansion foam system and in drills (e.g. Trainol), the new glycol-contained products (e.g. Hi Combat ATM of AngusFire), the protein foams (e.g. Sthamex F-15) which have poor effects in fuel-caused fires and are mainly used in drills as well for some purposes at sea.

PFOS phase-out plan of firefighting industry mainly contains the following five aspects:

1) Evaluation (on applications) and certification of new fire-extinguishing foam products in substitution of PFOS-contained foams;

2) To screen from substitute products/technologies, demonstrate the substitute technologies (in substitution of PFOS-contained surfactants), research and develop substitute products (fluorine surfactants containing no PFOS), get 3C certification, and get permit for market access;

3) To improve PFOS regulatory capacity of firefighting industry; to establish PFOS substances regulation mechanism, build the PFOS substances tracking information system, and train the on-the-job personnel;

4) To demonstrate BATs/BEPs on management (collection and disposal) of phased-out fire-extinguishing foam products, select a fixed fire drill place, collect wastewater (containing fire-extinguishing foams) from fire drills and demonstrate the PFCs removing technology, and provide technical support for demonstration (drills) of BEPs on harmless collection and disposal of fire-extinguishing agents;

5) To investigate and research the management of PFOS-contained foam concentrates and the disposal of the expired products;

It can be found that adverse environmental impacts may be generated by the demonstration and training in respect of the substitutes in firefighting industry. PFOS in fire-extinguishing foams will remain in natural environment. It may flow with firefighting wastewater into surface water or groundwater, causing continuous water pollution. In addition, the abandoned PFOS-contained fire-extinguishing agents are harmful substances and may enter natural environment. This will cause waste of resources and increase discharge of pollutants, and may cause secondary pollution.

In order to control and avoid those possible adverse impacts, the *Environmental Management Plan for Firefighting Industry* (model version) is prepared as follows. Implementing authorities can make adjustments in institutional responsibilities, mitigation measures, capacity building and training plan to increase the practicability of this plan. Departments and agencies involved should be committed to implementing this plan, which is deemed as a prerequisite for receiving the grant.

1. Environmental management institutions and their responsibilities

In this project, demonstration activities in the firefighting industry are mainly conducted at institutions such as training bases. Requirements such as environmental management institutions

Environmental management Framework, GEF-Reduction and phase-out of PFOS in priority sectors in China and their roles and responsibilities are shown as follows:

1) National Project Management Office: the NPMO is responsible for determining the screening principles and standards of demonstration projects, reviewing and determining demonstration projects proposed by the LPMOs, supervising the project implementation to ensure that regulatory requirements are met.
2) Competent authorities of different sectors: those authorities are responsible for proposing demonstration projects in accordance with the screening principles and standards specified by the NPMO and conducting daily supervision on project activities; Acting as the oversight institution, they need to supervise relevant enterprises and institutions over their implementations of international conventions; In addition, they also need to improve their capacity of PFOS management and control within the firefighting industry;
3) PIU：the PIU needs to implement international convention in accordance with national requirements and enhance institutional capacity-building; they are also responsible for demonstrating the Best Available Technology and Best Environmental Practices (BAT / BEP) for collecting and processing of abandoned fire extinguishing foams;
4) Technical Assistant Unit: they need to carry out research and demonstration of alternative technologies according to project contents, and develop substitute products and commodities for non-PFOS fluorine surfactants, which shall pass 3C certification to obtain market access;
5) Contractors: Contractors should strictly implement environmental protection measures.

2. Mitigation measures

Specific and workable mitigation measures need to be put forward in accordance with national regulations, standards and management methods by explaining how these measures are implemented, supervised and managed, and a budget for expenditure needs to be made clear, too. Main mitigation measures are shown in Table 5-1.

Table 5-1 Measures to Mitigate Environmental Impacts of the Use of PFOS in Fire Fighting Industry

Potential environmental impact	Mitigation measures	Implemented by	Supervised by
irefighting wastewater	(1) If condition permits, e.g. an emergency pool is built, the firefighting wastewater shall be collected, PFOS shall be separated from wastewater (if possible) to decrease the volume of wastewater, and finally the wastewater will be transported to the wastewater treatment plant of the enterprise (industrial park); (2) The BAT for AFFF concentrate and its washing water is burning in the high-temperature incinerator designed for the treatment of halogenated compounds; (3) This method is also applicable for small amount of solids containing high-concentration AFFF (soil, adsorbent, etc.); (4) PFCs in firefighting wastewater can be treated with electroflocculation and reverse osmosis technology or flotation separation technology; (5) High-concentration PFOS in firefighting wastewater can be collected by flotation method. After that, the remaining low-concentration PFOS can be removed with microporous aeration method; (6) If wastewater needs to be treated at site, GAC absorption method can be used.	Fire authority	Environmental protection authority
Solid wastes of PFOS-contained extinguishing agent	Main environmental management measures include: (1) Listing-type management: establish the List of PFOS-controlled Substances, establish and maintain the lists of firefighting industry, and regularly check the inventory of fixed or portal AFFF-contained fire equipment; (2) Use of foam in drills: use PFOS-free fire foams in daily drills; (3) Response to discharge: calculate and record the discharges including estimation of AFFF quantity, the property of the discharged substance (such as concentration or dilution), and the quantity of affected materials (such as soil, water etc.); (4) Management and recycling of wastes; (5) Final disposal: dispose of the wastes containing unknown amount of PFOS or similar components irreversibly at the min. temperature of 1100°C; (6) Use of PFOS-free substitutes: There are two major types of substitutes. The first type is non-PFOS-based short-carbon fluorine surfactants, e.g. C6 telomer. The second type is fluoride-free foams, such as the silicon-based surfactants and hydrocarbon surfactants, which are usually used in combination with fluorine surfactants.	Fire authority	Environmental protection authority
Occupational health	(1) The treatment and disposal of wastes must be in compliance with national or local regulations; (2) When operating special equipment, the operator shall be careful that the eyes, skin or clothes can’t have contact with PFOS-contained product; (3) Operators shall wear protective devices (such as goggles, rubber or chloroprene rubber) to prevent intake of PFOS-contained product or inhalation of volatile PFOS-contained substance; (4) The eye wash bottle or other washing articles can be easily accessible.	Fire authority	Environmental protection authority

3. Capacity building and personnel training plan

It aims to familiarize project stakeholders with EMP, thus enhancing their implementation capacity. The training plan shall include: training contents, time, and number of trainees and cost estimation for PMO, PIU, firefighting product users.

4. Monitoring and report system

It refers to periodic reporting of EMP implementation. If new environmental problem or new potential impact is found, suggestions and measures shall be proposed in the report.

Part II Social Management Framework

1. Introduction to the Project

1.1. Background of the Project

The GEF-financed PFOS Reduction and Phase-out Project (perfluorooctane sulfonates) in Priority Sectors in China (hereinafter, the "Project") initiated by FECO and the Bank was approved by the Global Environmental Facility (GEF) on June 4, 2015. The Project is a chemical management project that aims to help China perform the compulsory obligation of PFOS phase-out in the Stockholm Convention on Persistent Organic Pollutants in order to minimize PFOS use and emissions, and promote PFOS reduction in priority sectors. The Project involves a number of PFOS application industries, including PFOS manufacturing, electroplating, pesticide, firefighting, oil production, and semiconductor. Two projects will be applied for and implemented in stages. The Project is Stage 1, and focuses on demonstration, replacement, reduction and phase-out in major enterprises in the manufacturing, electroplating, pesticide and firefighting sectors. The gross investment in the Project is USD145.3 million, including a GEF grant of USD24.25 million.

1.2. Scope of the Project

The target sectors for PFOS phase-out are PFOS production industries and three PFOS application industries: electroplating, imported fire ant control and firefighting. The major content of the project is to close up or convert product of PFOS manufacturing enterprises, demonstrate pollution control, phase-out and substitution of PFOS in electroplating and pesticide industries, as well as demonstrate supervision capacity building in Hubei Province and Guangdong Province.

Specifically, it includes four components:

Component 1: Phase-out of PFOS manufacturing enterprises. Including:

5) To switch product of PFOS manufacturing enterprises, including: technology transfer, R & D, environmental characteristic screening of alternative products;
6) To conduct environmentally sound management of product changing of PFOS production enterprises, including: equipment investment, worker retraining, installation of security facilities, and BAT/BEP of cleaner production;
7) To provide support for existing PFOS production lines to introduce BAT/BEP of cleaner production;
8) To close production line for non-acceptable purposes, including the contamination assessment of production plant and its soil, and necessary cleanup work.

Component 2: Phase-out and substitution of PFOS application industries. Including:

(4) PFOS substitution in electroplating industry

7) To imitate technical demonstration for the closed system reformation of chrome-plating enterprises;
8) To initiate comprehensive technical demonstration for PFOS phase-out of electroplating industrial park: a) To investigate the chromium mist inhibitors used by chrome-plating enterprises in the park and make a list of PFOS-contained products; b) To use non-PFOS-contained chromium mist inhibitors in substitution of the PFOS-contained products; c) To minimize the use of chromium mist inhibitors; d) To add PFCs absorption equipment in sewage treatment plants in the park to improve sewage treatment technology; e) To carry out technical demonstration of trivalent chromium.
9) To investigate and evaluate the applications of trivalent chromium technology;
10) To regulate the production and use of chromium mist inhibitors;
11) Evaluate the technological economy and environment friendliness of alternatives products;

12) Improvement of relevant rules and regulations: a) to revise the local standard - *Discharge Standard of Water Pollutants for Electroplating*; b) to revise the standard - *Emission Standard of Pollutants for Electroplating*; c) to revise the standard - *Assessment Indicator Frame of Cleaner Production for Electroplating Industry*; d) to compile the standard - *Guideline on Best Available Technologies of POPs Pollution Prevention and Control for Chrome-plating Industry*; e) To implement the management mode of "pollutant discharge permit" for chrome-plating enterprises.

(5) PFOS substitution in imported fire ant prevention and control industry

6) To initiate technical demonstration of new products in substitution of Sulfluramid: to build imported fire ant prevention and control demonstration areas in five provinces, namely Guangxi, Yunnan, Hainan, Guangdong and Fujian, which are most seriously hit by imported fire ant, and on this basis, formulate standard operation guidelines and evaluate the technological economy of the alternatives products.
7) To enhance knowledge dissemination, including the prevention and control of imported fire ant and the hazards of POPs;
8) To choose potential alternativesalternatives products;
9) To arrange discussions and trainings on imported fire ant prevention and control and alternatives products (in substitution of Sulfluramid);
10) To revise technical standards and regulate the use of pesticides against imported fire ant: a) To work out the *Technical Scheme for Imported fire ant Prevention and Control* and the *Directory and Use Instructions of Pesticides against Imported fire ant*; b) To revise the *Technical Specifications for Chemical Prevention and Control of Imported fire ant* and carry out researches, e.g. international comparison concerning the registration of pesticides against imported fire ant and other quarantine pests and the supporting policies for PFOS phase-out in imported fire ant prevention and control industry.

(6) PFOS substitution in firefighting industry

6) Evaluation of applications of new products in substitution of foam extinguishing agent and the certification of new products;
7) Screening, research & development and application of alternatives products/technologies;
8) To improve PFOS regulatory capacity of firefighting industry: to establish PFOS substances regulation mechanism, build the PFOS substances tracking information system, and train the on-the-job personnel;
9) To collect BATs/BEPs from foam extinguishing agents used in firefighting drills.
10) To investigate and research the management of PFOS-contained foam concentrate products and the disposal of the expired products;

Component 3: PFOS management and regulatory framework. Including:

10) Policy and legislative support, including restrictions on the use and production of PFOS as stated in Stockholm Convention;
11) Implementing the PFOS environmental monitoring, supervision capability building;
12) To support the establishment of China PRTR (Pollutant Release and Transfer Registers) database;
13) To control the import and export of PFOS and PFOS-containing material / goods / products;
14) To carry out capacity building for feature screening of POPs alternatives;
15) To provide guidance on BAT/BEP and cleaner production to key departments through industrial associations and research institutions, and to provide support for technical training;
16) To update waste / wastewater standards of PFOS and PFOS-containing products and materials;

17) To provide identification/environmental certification of PFOS alternatives in the next project phase; and

18) To improve the consciousness of general public, industry practitioners and other users.

Component 4: Project management, monitoring and assessment.

This component is designed to monitor and evaluate the whole project (various industries) according to the requirements of the GEF and World Bank and grant funds for the establishment and normal operation of the national PMO at FECO and the provincial PMOs at the Environmental Protection Departments of project provinces.

1.3. Purpose of this SMF

The Project involves PFOS reduction and phase-out. The sites and scopes of the components are unclear for the moment, but they may involve LA, HD, worker unemployment and other social risks during implementation. Therefore, it is necessary to prepare a Social Management Framework (SMF) for the Project.

Since the Project is mostly implemented in urban or suburban areas, and does not involve any minority habitat, this SMF does not include an Indigenous Peoples Policy Framework (IPPF).

The Social Safeguards Policy Framework (SMF) is developed to ensure that all measures are taken to avoid or minimize social impacts in all project activities. Unavoidable impacts will be identified according to the applicable Bank policies, and PRC laws and regulations, and necessary mitigation measures developed and implemented.

The SMF establishes the objectives, procedure, organizational framework and implementation arrangements for identifying and managing potential social impacts arising from project activities, and public participation and grievance redress mechanisms.

2. Implementation Procedure for Social Management Policies

According to enterprises in the PFOS manufacturing, electroplating, pesticide and firefighting sectors to be identified under the Project, social impacts will be screened and alleviated, and management measures developed and implemented through the following steps:

- Step 1—identifying subprojects and target enterprises—enterprises in the PFOS manufacturing, electroplating, pesticide and firefighting sectors;
- Step 2—screening potential social safeguards and impacts (labor unemployment) during management according to the applicable PRC regulations and Bank policies, and determining required social safeguard documents;
- Step 3—preparing terms of reference (TORs) for the social safeguard consultants, and the Social Assessment (SA) Report and the Resettlement Action Plan (RAP) for the affected enterprises;
- Step 4—review of the TORs for the SA Report and/or RAP by the Bank according to the social safeguard policies;
- Step 5—preparing social safeguard documents and the SA Report, and conducting discussion and disclosure;
- Step 6—approval of the social safeguard documents and the SA Report; and
- Step 7—implementation, supervision, monitoring and evaluation

2.1. Identification of Potential Social Impacts and Approval

The PMOs or appointed qualified social experts and consultants will screen each

component for social safeguard policies, and report to FECO; FECO or the appointed qualified social experts and consultants will review screening, and submit the screening results to the Bank for approval to identify the nature and scope of potential social impacts of project activities. ***Appendix 1*** provides a guide for preliminary screening in this regard.

The screening results will be used to identify the type of safeguard documents required for each component.

Social safeguard screening

The PMOs will screen all components for social impacts, including: 1) necessity of LA (if any), and population affected by involuntary resettlement (permanent and temporary); 2) if the component is in a minority habitat (through review of the demographic information of the project area); and 3) unemployed workforce of the enterprises affected by PFOS reduction and phase-out. The screening and identification of worker health, community health and other health risks will be included in the Environmental Management Framework. The PMOs will use the screening tools set out in ***Appendix 1*** to determine the severity of such impacts, and identify social safeguard documents to be prepared.

Social safeguard documents

The social safeguard documents of each component depend on its impacts:

- **RAP**: If more than 200 persons are affected by LA and HD, an RAP should be prepared, otherwise an ARAP should be prepared.
- **SA**: If any major social impact is expected to arise, such as closing down PFOS manufacturing or using enterprises to cause worker unemployment, an SA report should be prepared.

In addition, consideration should be given to social gender during project preparation and implementation. Social fairness and gender equality will be promoted through extensive, equal participation, and consultation with local enterprise managers and workers (including affected local female workers). Particular attention should be paid to the participation of ethnic minorities and vulnerable groups (including women). Sensitivity to social issues should be maintained during LA, resettlement, and employment assistance for enterprises (if any). Equal participation and social gender sensitivity will be reflected in project activities, such as capacity building, consultation, compensation, and livelihood restoration.

2.2. Preparation and Review of the TORs

After the social safeguard documents have been approved by the Bank, the PMOs or appointed qualified social experts and consultants will prepare TORs according to the

Bank's social safeguard policies, and submit them to FECO. FECO or the appointed social experts and consultants will review the TORs, and submit them to the Bank for approval.

If the Project involves LA and HD, OP/BP4.12 will be triggered, and a full RAP or ARAP prepared. If the affected population exceeds 200, a full RAP should be prepared. If the affected population is less than 200 and they are affected slightly (not losing all residence and resulting loss of productive assets less than 10%), an ARAP should be prepared. Once a full RAP is to be prepared, FECO will develop TORs with the assistance of experienced social experts. A full RAP should be based on accurate social survey results, and include measures to mitigate negative impacts from resettlement (e.g., compensation for land, buildings and other assets, assistance during the transition period, assistance in livelihood restoration). In order to ensure that necessary resettlement measures will not replace or restrict the use of resources and assets before project implementation, resettlement activities should be implemented together with the project investment plan. See Chapter 3 for the main tasks of the RAP. ***Appendix 2*** provides the TORs of the full RAP.

The TORs of the RAP and the SA report will be reviewed and confirmed by the Bank. The Bank's social safeguard experts will pay a site visit to further identify social risks, and confirm or improve the TORs.

2.3. Preparation of Safeguard Documents, Discussion and Disclosure

Preparation of safeguard documents

Once the screening and documentation requirements are accepted by the Bank and confirmed by the government, the PMOs will prepare detailed safeguard documents and develop impact mitigation measures in coordination with the appointed social and resettlement experts.

Before the finalization of the safeguard documents, they should be released timely at places that can be reached by primary stakeholders, and in forms and languages that they can understand. Particular attention should be paid to this to ensure that potential APs have

sufficient time and obtain drafts before consultation.

For any component requiring the RAP and the SA Report, public consultation will be conducted at least twice at the preparation stage. The scope of social issues will be identified at the beginning of preparation of the safeguard documents, and consultation on preliminary results conducted before the finalization of the safeguard documents.

All the above safeguard documents and the SA Report should be submitted to the Bank via FECO for prior review and agreement and they should include Chinese and English versions.

Discussion and disclosure

The level of public consultation and the scope of information disclosure should be consistent with the severity of social impacts of the component. The information to be disclosed should at least include the design and impacts of the component, and recommended mitigation measures. At the design and implementation stages, the above information should be updated and reported to stakeholders. Multiple disclosure modes may be used, possibly including poster, brochure, newspaper, Web and community meeting. Before consultation, all safeguard documents should be disclosed at public places accessible for APs and other stakeholders in order to lay a foundation for meaningful consultation. The disclosure and consultation mechanism should be planned and specified in the relevant safeguard documents.

Grievance redress

If any affected individual or organization thinks that it is not properly treated under the Project, a grievance redress mechanism is necessary, including: 1) a recording and reporting system, including written and oral appeals; 2) handled by persons designated by local governments; and 3) restriction on appeal handling time. This mechanism will be specified in the relevant safeguard documents. During implementation, the PMOs will perform regular M&E on the operation of this mechanism.

2.4. Approval of Safeguard and SA Documents

The PMOs should review and approve the social safeguard documents in accordance with the domestic regulations.

The social safeguard documents should be submitted to the Bank for approval 3 months before project implementation. The Project cannot be implemented until such documents are approved. The RAP and the SA Report should have been reviewed and approved by the Bank's social experts before the component is approved.

2.5. Implementation, Supervision, Monitoring and Evaluation

Implementation

The project developer is responsible for the implementation of the safeguard measures at the implementation stage.

Supervision

FECO or the appointed social experts and consultants, and PMOs are responsible for the implementation of the actions related to safeguard approved by the government and the Bank. The Bank's task force will visit the project area regularly during implementation for the purpose of:

- Directing and assisting in the preparation of the safeguard tools;
- Reviewing screening results, reports and safeguard documents; and
- Supervising the implementation of the safeguard tools to ensure that they comply with the Bank's policies.

Monitoring & Evaluation

FECO or the PMOs will appoint qualified, experienced consultants to perform M&E to obtain key social information on the components and information on the effectiveness of the mitigation measures. For any component requiring an RAP, the PMOs will appoint third party independent consultants accepted by the Bank to perform external M&E on the implementation of the RAP and the Social Management Plan (Workers' Resettlement Plan). External M&E reports will be submitted to the Bank and the PMOs.

3. Resettlement Policy Framework

3.1. Purpose of the RPF

Since the Project may involve LA and involuntary resettlement, the borrower has prepared the RPF, and related principles and guidelines in accordance with the Bank's policy OP4.12 to guide resettlement activities.

3.2. Objectives, Principles and Terms

This RPF is based on OP4.12 "Involuntary Resettlement" in the World Bank Operational Manual issued in December 2001, and the overall objectives are:

- Involuntary resettlement should be avoided where feasible, or minimized, exploring all viable alternative project designs;
- Where it is not feasible to avoid resettlement, resettlement activities should be conceived and executed as sustainable development programs, providing sufficient investment resources to enable the persons displaced by the project to share in project benefits;
- Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them, in real terms, to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher.

This RPF defines the principles and objectives of resettlement, and appropriate guidelines, rights, and legal and institutional framework, compensation and restoration patterns, participation characteristics, and appeal procedure for resettlement, and is used to guide compensation, resettlement and restoration matters.

- Each RAP should be based on identifiable basic information collected, and include the following aspects:
- Those whose farmland or rural houses together with housing sites is/are wholly or partly affected by the Project (permanently or temporarily);
- Urban houses wholly or partly affected by the Project (permanently or temporarily);
- Commercial facilities (enterprises and stores) wholly or partly affected by the Project (permanently or temporarily);
- Young crops and ground attachments wholly or partly affected by the Project (permanently or temporarily).

The key principles and objectives of this RPF are as follows:

- Acquisition of land and other assets, and related resettlement should be minimized where possible;
- As of the baseline survey date, all APs are entitled to restoration measures to help them improve or at least their living standard, ability to earn income and production level; the lack of legal title to asset losses does not impede their entitlement to resettlement measures;
- The resettlement measures available include: (1) residential houses and other

buildings are compensated for at replacement cost free from depreciation or recovery of residual value; (2) cash or other means of compensation, such as land replacement and endowment insurance; (3) equal replacement of housing and housing sites acceptable to APs; and (4) subsidies for relocation and living;

- If APs can accept the replacement of housing, housing sites and farmland, replacements should be as close to their lost land as possible;
- The transition period of resettlement should be minimized, and restoration measures should be made available to APs at the project site before the preset starting date;
- The acquisition plan of land and other assets, and the restoration measures offered shall be negotiated with APs repeatedly to ensure minimum interference; APs will be empowered before the preset starting date;
- The existing community service and resource levels should be maintained or improved;
- Whenever and wherever necessary, financial and material resources for resettlement and restoration must be available; the budget in the RAP should include contingencies;
- The institutional and organizational arrangements should ensure that assets and resettlement are designed, planned, consulted and implemented effectively and timely;
- The implementation of the RAP shall be supervised, monitored and evaluated effectively and timely.

3.3. RAP Preparation

The preparation and implementation of the RAP (including the payment of all resettlement costs) will be the responsibility of the borrower. The Ministry of Environmental Protection is fully responsible for the Project, and the Project is implemented by FECO.

When the affected population of a component exceeds 200, the provincial and municipal PMOs will prepare an RAP in coordination with the local governments and the owners, and submit it to the Bank through FECO; in addition, APs should be fully consulted so that they have a chance to participate in the design and implementation of the RAP.

On the basis of the Operational Policy on Involuntary Resettlement (OP4.12), the RAP will cover the following (if relevant), and anything unrelated to the Project should be specified in the RAP:

- General description of the Project;
- Identification of potential impacts of the Project;
- Objectives (the main objectives of the resettlement program);
- Socioeconomic studies: The findings of socioeconomic studies to be conducted in the early stages of project preparation and with the involvement of potentially displaced people;
- Legal framework: The findings of an analysis of the legal framework, covering the scope of the power of eminent domain and the nature of compensation associated with it, the applicable legal and administrative procedures, environmental laws and

social welfare legislation, laws and regulations, and any legal steps necessary;

- Institutional framework: covering the identification of agencies responsible for resettlement activities and NGOs that may have a role in project implementation; an assessment of their institutional capacity, and any steps that are proposed to enhance their institutional capacity;
- Eligibility: Definition of APs and criteria for determining their eligibility for compensation and other resettlement assistance;
- Valuation of and compensation for losses;
- Resettlement measures: a description of the packages of compensation and other resettlement measures;
- Resettlement site selection, preparation and rearrangement;
- Offering of housing, infrastructure and social services;
- Environmental protection and management;
- Public participation and consultation, where the APs and the related communities must be included;
- Integration with host populations: measures to mitigate the impact of resettlement on any host communities;
- Grievance procedures: affordable and accessible procedures for third-party settlement of disputes arising from resettlement;
- Organizational responsibilities;
- Implementation schedule;
- Costs and budget;
- M&E.

The RAP should be completed no later than 6 months before the starting date of resettlement, and submitted to the Bank for consideration at least 3 months before that. Only after the Bank has accepted the RAP can compensation, resettlement and restoration activities begin. Such activities should be completed before the commencement of civil engineering.

When the affected population of a component does not exceed 200, the provincial PMO will prepare an abbreviated resettlement action plan (ARAP) in close cooperation with the local governments and the owners, and submit it to the Bank through the Ministry of Environmental Protection; in addition, APs should be fully consulted so that they have a chance to participate in the design and implementation of the RAP.

On the basis of the Operational Policy on Involuntary Resettlement (OP4.12), the ARAP covers the following minimum elements:

- a census survey of APs and valuation of assets;
- description of compensation and other resettlement assistance to be provided;
- consultations with displaced people about acceptable alternatives;
- institutional responsibility for implementation and procedures for grievance redress;
- arrangements for monitoring and implementation; and
- a timetable and budget.

The ARAP should be completed no later than 4 months before the starting date of resettlement, and submitted to the Bank for consideration at least 3 months before that. Only after the Bank has accepted the ARAP can compensation, resettlement and restoration activities begin. Such activities should be completed before the commencement of civil engineering.

3.4. Institutional and Legal Framework

The legal framework guiding the implementation of the RAP is based on the Bank's policy on involuntary resettlement (OP4.12), the applicable laws, regulations and ordinances of the state, and the project provinces and cities.

The PRC has developed a complete legal framework and policy system on LA, HD, resettlement and compensation, including the Land Administration Law of the PRC (amended on August 28, 2004). Within the state legal and policy framework, local governments have promulgated relevant local regulations and policies to manage and direct local LA, HD, resettlement and compensation work. The provincial governments (Fujian, Hubei and Jiangxi as preliminarily identified) have promulgated local regulations and policies in accordance with the applicable state laws and policies to manage and direct relevant local work.

The key laws, regulations and ordinances of the PRC used to prepare this RPF and ensure its legal validity include: 1) laws and policies on LA (see ***Appendix 3***); 2) laws and policies on social security (see ***Appendix 3***); and 3) laws and policies on HD, including:

- Regulations on House Acquisition on State-owned Land and Compensation (Decree No.590 of the State Council)
- Measures for the Acquisition and Appraisal of Houses on State-owned Land (HC [2011] No.77)

The latest policies will apply in practice.

According to the Notice of the Ministry of Land and Resources on Doing a Better Job in LA Management (MLR [2010] No.238), "All localities shall establish a dynamic adjustment mechanism for compensation rates for land acquisition, adjust compensation rates for land acquisition every 2 or 3 years depending on economic level and local per capita income growth, and improve the compensation level for land acquisition gradually."

The purpose of preparing the RAP is to ensure that the APs have sufficient opportunities to replace their lost assets, and improve or at least restore their income level and living standard. To realize this purpose, all APs should be identified, and it should be ensured that all APs think the remedies defined in the RAP are rational. In consideration of the main types of impacts (e.g., LA, demolition of urban and rural residential houses, demolition of non-residential properties (enterprises, stores, etc.)), the following measures are usually taken:

APs losing farmland will be entitled to the following compensation and restoration measures:

- Land reserved for resettlement obtained through LA should be used to develop the collective economy with the consent of villagers, offer collective jobs for collective resettlement, generate operating income, etc.
- Where land reallocation is impossible, land-expropriated farmers must be identified. They will be provided with jobs with a remuneration level at least equivalent to their lost income, or receive a resettlement subsidy at 4-6 times the average annual output value (AAOV) of the acquired land in the 3 years before LA. If the former living standard of the APs still cannot be fully restored like this, resettlement subsidy may be increased to 15 times the AAOV.
- If land compensation fees and resettlement subsidy are still insufficient to restore the living standard of the APs, they will receive subsidies from fees on the use of state-owned land.
- Land compensation fees and resettlement subsidy will be paid to the affected village committees, and used to: ⑴increase cultivated area if land is available; ⑵improve agriculture through irrigation, etc.; and ⑶develop nonagricultural income. Like fixed assets, affected young crops, fruit and commercial forests will be compensated for at replacement cost.
- The lost income, young crops and infrastructure, and land restoration costs of the persons affected by temporary land occupation will also be compensated for.
- Eligible APs will be included in endowment insurance for LEFs or the social security system; and
- The APs will have priority in receiving job opportunities and skills training under the Project.

Demolished houses and attachments will be compensated for as follows, and the following restoration measures will be taken:

- Supply of resettlement housing of equal value;
- Compensation at full replacement cost;
- Reconstruction or restoration of all affected facilities and services (e.g., roads, water and power supply, telephone, cable TV, schools);
- The subsidy during the transition period should ensure that all assets are relocated or temporary housing is obtained.

The RAP prepared should include an entitlement matrix for the APs. See ***Appendix 4*** for a sample.

3.5. Implementation Process

The RAP should include an implementation schedule for all activities to be conducted. If necessary, compensation payment, other entitlement restoration measures (in cash or in kind) and resettlement should at least be completed one month before LA. If full compensation is not paid or necessary assistance measures are not available before LA, a transition subsidy should be provided.

3.6. Financial Arrangements

The provincial PMOs, local governments or owners will bear all costs related to LA and resettlement. Any RAP consistent with this RPF must include estimated costs and a budget. Whether identified as APs at the RAP preparation stage or not, and whether sufficient funds are available or not, all those adversely affected by LA and HD are entitled to compensation or any other appropriate relief measure. For the above reason, the budget in the RAP should include contingencies, which are usually 10% or more of the estimated resettlement budget in order to cover contingent resettlement costs.

The compensation rates specified in the RAP provide a basis for the calculation of compensation fees for resettlement, which should be fully paid to individuals or collectives losing land or other assets, and should not be deducted for any reason. The RAP should describe by what means compensation fees are paid by the component owners to the affected villages or villagers. A rationale is that the fund flow should be as direct as possible with minimum intermediate links.

4. Policy Framework for SA/Worker Resettlement

4.1. Purpose

The main purpose of SA is to identify the potential social impacts and risks of the Project, and propose measures and suggestions to avoid or minimize negative impacts and enhance positive impacts.

During project preparation, needs of different stakeholders will be collected in a participatory manner so that the Project can benefit more stakeholders, promote local inclusive development.

Through the preliminary identification of social risks, since some enterprise workers will be faced with the risk of unemployment due to PFOS reduction and phase-out at the construction stage, the borrower has prepared the RPF, and related principles and guidelines guide workers' resettlement activities and provide social protection for affected workers.

4.2. Preparation of the SA/Worker Resettlement Plan

Based on screening, workers of affected enterprises may become unemployed or be subject to job transfer due to PFOS reduction and phase-out, so it is necessary to assess the Project's potential impacts on affected workers, and develop a workers' resettlement plan (WRP) on the basis of public consultation.

The PMOs will judge if affected workers support the Project extensively based on free, prior, and informed consultation. If such support is available, the borrower should prepare a detailed WRP or include a chapter on workers' resettlement in the SA report. The WRP or the chapter on workers' resettlement in the SA report should include the following:

- A summary of baseline information of affected enterprises (see ***Appendix 5***), including ages, educational levels, skills, training, livelihoods, and employment modes of workers;
- Legal framework: reviewing laws and regulations applicable to the Project and workers' protection;
- Identification of potential project impacts;
- Public participation and consultation, where free, prior, and informed consultation will be conducted with affected workers at the preparation stage to win their extensive support for the project;
- Resettlement plan, to be developed based on the identification of negative impacts on affected workers to avoid, minimize or compensate for such impacts;
- the financial budget and financing plan for the WRP;
- a procedure for addressing appeals from affected workers arising from project implementation;
- institutional arrangements; and
- M&E

Before the determination of a component's eligibility for Bank funding, the PMO should submit a workers' resettlement policy framework or SA report (including a chapter on workers' resettlement) to which the local government is committed to the Bank for review 3 months before implementation. Such component will be implemented after review and approval only. The approved WRP should be disclosed on local newspapers and government websites before implementation.

4.3. Institutional and Legal Framework

The legal framework for the protection of labor rights mainly includes the Labor Law of the PRC (effective from January 1, 1995), Labor Contract Law of the PRC (effective from January 1, 2008), Employment Promotion Law of the PRC (effective from January 1, 2008), Social Insurance Law of the PRC (effective from July 1, 2011), etc., as shown in ***Appendix 6***. The latest policies will apply in practice.

Basic labor rights: Laborers shall have the right to be employed on an equal basis, choose occupations, obtain remuneration for their labor, take rest, have holidays and leaves, obtain protection of occupational safety and health, receive training vocational skills, enjoy social insurance and welfare, and submit applications for settlement of labor disputes, and other rights relating to labor as stipulated by law. The State shall take various measures to promote employment, develop vocational education, lay down labor standards, regulate social incomes, perfect social insurance system, coordinate labor relationship, and gradually raise the living standard of laborers. (Articles 3 and 5 of the Labor Law of the PRC)

Laborers shall, through the assembly of staff and workers or their congress, or other forms in accordance with the provisions of laws, rules and regulations, take part in democratic management or consult with the employers on an equal footing about protection of the legitimate rights and interests of laborers. (Article 8 of the Labor Law of the PRC)

Employment promotion: The State shall create conditions for employment and increase opportunities for employment by means of the promotion of economic and social development. Local people's governments at various levels shall take measures to develop various kinds of job—introduction agencies and provide employment services. Laborers shall not be discriminated against in employment, regardless of their ethnic community, race, sex, or religious belief. Females shall enjoy equal rights as males in employment. (Articles 10-13 of the Labor Law of the PRC)

The State encourages various types of enterprises to provide more job opportunities by

creating new industries or expanding business operation within the scope as prescribed by laws and regulations. The State develops both domestic and foreign trade as well as international economic cooperation, thus to develop more channels for employment. When people's governments at or above the county level make arrangements for government investment or decide on major construction projects, they shall pay attention to bringing into play the role of such investment or projects in promoting employment and providing more job opportunities. The State implements the fiscal policies which are favorable for the promotion of employment, increases the input of funds and improves employment environment in order to increase employment. The State establishes a sound unemployment insurance scheme to ensure the basic living standards of the unemployed in accordance with law and to promote their re-employment. The State encourages enterprises to provide more job opportunities and to support the unemployed and the disabled in finding jobs. The State adopts financial policies favorable for promotion of employment, open up more channels for financing small and medium-sized enterprises, and encourages financial institutions to improve financial services, by giving such enterprises increased support in loans and providing, within a given period of time, small loans, etc. to support persons who start undertakings independently. The State applies an employment policy whereby to make overall plans for both urban and rural areas, establishes a sound system under which to provide equal job opportunities to both urban and rural people and give guidance to the surplus agricultural workers in their effort to find other jobs in an orderly manner. People's governments at all levels shall take measures to gradually improve and implement the labor and social insurance policies adapted to such flexible employment as part-time jobs, in order to provide assistance and services to the persons who look for flexible employment. Local people's governments at all levels and the relevant departments shall give better guidance to the unemployed in starting self-employed businesses, and provide them with policy consultation, vocational training, instructions on how to start a business and other services. (Articles 11-24 of the Employment Promotion Law of the PRC)

Labor safety and health: The employer must establish and perfect the system for occupational safety and health, strictly implement the rules and standards of the State on occupational safety and health, educate laborers on occupational safety and health, prevent accidents in the process of work, and reduce occupational hazards. Facilities of occupational safety and health must meet the standards stipulated by the State. (Articles 52 and 53 of the Labor Law of the PRC)

Occupational training: The State shall take various measures through various channels to expand vocational training undertakings so as to develop professional skills of laborers, improve their qualities, and raise their employment capability and work ability. People’s governments at various levels shall incorporate the development of vocational training in the plans of social and economic development, encourage and support all enterprises, institutional organizations. Societies and individuals, where conditions permit, to sponsor all kinds of vocational training. The employer shall establish a system for vocational training, raise and use funds for vocational training in accordance with the provisions of the State, and provide laborers with vocational training in a planned way and in the light of the actual situation of the unit. (Articles 66, 67 and 68 of the Labor Law of the PRC)

People's governments at or above the county level shall improve coordination under an overall plan, encourage and support various types of vocational colleges and schools, vocational skills training institutions and employing units to, in accordance with law, provide pre-employment training, on-the-job training, re-employment training and training for starting undertakings, and shall encourage the workers to participate in various forms of training. Local people's governments at or above the county level and the relevant departments shall, in light of the market demand and the trend of industrial development,

encourage enterprises to do a better job in vocational education and training and give them guidance in this endeavor. The State takes measures to establish a sound labor reserve system. Local people's governments at or above the county level shall provide a certain period of vocational education and training to the graduates from junior and senior middle schools who need to find jobs, in order to enable them to acquire the relevant vocational qualifications or the skills of certain professions. Local people's governments at all levels shall encourage and support employment training, help the unemployed to upgrade their vocational skills and increase their employability and their capability of starting undertakings. The unemployed who participate in such training shall, in accordance with relevant regulations, be entitled to receive the training subsidies provided by the governments. Local people's governments at all levels shall take effective measures to make arrangement for and give guidance to the rural workers who go to cities for employment to participate in skill training in this respect, and encourage various types of training institutions to provide skill training to such rural workers to increase their employability and capability of starting undertakings. (Articles 46-50 of the Employment Promotion Law of the PRC)

Labor dispute: Where a labor dispute between the employer and laborers takes place, the parties concerned may apply for mediation or arbitration or take legal proceedings according to law, or may seek for a settlement through consultation. Where a labor dispute takes place, the parties involved may apply to the labor dispute mediation committee of their unit for mediation; if the mediation fails and one of the parties requests for arbitration, that party may apply to the labor dispute arbitration committee for arbitration. Either party may also directly apply to the labor dispute arbitration committee for arbitration. If one of the parties is not satisfied with the adjudication of arbitration, the party may bring the case to a people’s court. (Articles 77 and 79 of the Labor Law of the PRC)

Unemployment insurance: An unemployed person shall receive unemployment benefits from the unemployment insurance fund when the following conditions are met: The employer and the person in question have made unemployment insurance contributions no less than one year prior to the unemployment; Termination of employment is not caused by the intentional actions of the person in question; and The person in question has registered as unemployed and is a jobseeker. (Article 45 of the Social Insurance Law of the PRC)

When the cumulative length of contribution payment of the unemployed person and his or her employer prior to unemployment is greater than one year and less than five years, the maximum duration for unemployment benefits shall be 12 months; when the cumulative length is greater than five years but less than ten years, the maximum duration for unemployment benefits shall be 18 months; when the cumulative length exceeds ten years, the maximum duration for unemployment benefits shall be 24 months. When a person becomes unemployed once again after taking up a new job, the length of contribution payment shall be counted anew, the duration for unemployment benefits shall be counted together with the balances left over from the entitled duration in the previous case, and the maximum shall not exceed 24 months. (Article 46 of the Social Insurance Law of the PRC)

Unemployment assistance: People's governments at all levels shall establish a sound employment aid system and, in their support and assistance, give priority to the persons who have difficulty in finding jobs, by means of exemption and deduction of taxes and fees, discount interest loans, social insurance subsidies, post subsidies, by providing public welfare jobs and through other channels. The public welfare jobs which are created through government investment shall first be offered to the persons who have difficulty in finding jobs and meet the requirements of such jobs. Local people's governments at all levels shall improve their service in respect of employment aid at the grass-roots level, place emphasis on assisting the persons who have difficulty in finding jobs and offer them employment services and aid related to public welfare jobs that are suited to them. People's

governments at all levels shall take special supportive measures to promote the employment of disabled persons. Local people's governments at or above the county level shall adopt diversified forms of employment, expand the range of public welfare posts, create job opportunities, and ensure that at least one member is employed in each urban family that needs employment. The State encourages the cities open to resources exploitation and the independent industrial and mining areas to develop industries that meet market demand and guide people to find jobs in these industries. (Articles 52-57 of the Employment Promotion Law of the PRC)

Protection of women's rights and interests: Females shall enjoy equal rights as males in employment. It shall not be allowed, in the recruitment of staff and workers, to use sex as a pretext for excluding females form employment or to raise recruitment standards for the females, except for the types of work or posts that are not suitable for females as stipulated by the State. (Article 13 of the Labor Law of the PRC)

The employer shall not revoke labor contracts with female workers during pregnant, puerperal, or breast-feeding period. (Article 29 of the Labor Law of the PRC)

The State shall provide female workers and juvenile workers with special protection. It is prohibited to arrange female workers to engage in work down the pit of mines, or work with Grade IV physical labor intensity as stipulated by the State, or other work that female workers should avoid. Female workers during their menstrual periods shall not be arranged to engaged in work high above the ground, under low temperature, or in cold water or work with Grade III physical labor intensity as stipulated by the State. Female workers during their pregnancy shall not be arranged to engage in work with Grade III physical labor intensity as stipulated by the State or other work that they should avoid in pregnancy. Female workers pregnant for seven months or more shall not be arranged to extend their working hours or to work night shifts. (Articles 58-61 and 63 of the Labor Law of the PRC)

Where an employer encroaches upon the legitimate rights and interests of female and juvenile workers in violation of the stipulations of this Law on their protection, the labor administrative department shall order it to make corrections, and impose a fine. If harms to female and juvenile workers have been caused, the unit shall assume the responsibility for compensations. (Article 95 of the Labor Law of the PRC)

4.4. Implementation Process

The WRP should include an implementation schedule for all activities to be conducted. Resettlement programs should be developed in advance, deliberated and adopted at workers' congresses (including deputies of female workers), and approved by the competent authorities, PMOs and Bank. At the implementation stage, the PMOs will be responsible for WRP implementation, collect needs of affected workers, especially female workers, through information disclosure and public participation, and propose measures to enhance positive impacts and mitigate negative impacts.

4.5. Main settlement measures

Keep personnel placement

The sub project owners for the restructuring of state-owned enterprises, the staff retention before the restructuring enterprises work experience combined with the calculation for working life of the enterprise after the reform, no need to pay economic compensation to workers. Retained single sub project owners for the restructuring of non state-owned enterprises, in addition to the original solution can renew the labor contract, the new labor contract. To pay economic compensation.

Labor relations into the labor market to seek employment and re employment

1 to terminate the labor contract: full consultation, by consensus, may terminate the labor

contract. After failed to negotiate with the worker, change, termination of the labor contract content agreement, shall be thirty days in advance written notice to the laborer or the extra pay workers a monthly wages after the termination of labor contract.

2 pay economic compensation: a single sub project owners should be according to the staff reductions in this period of work units, each year to pay one month's wages to pay economic compensation to the worker. For more than six months but less than one year, as one year; less than six months, to the labor economy the compensation paid half a month salary. The monthly salary in accordance with the termination of the labor contract in the first twelve months of the average wage calculation, economic compensation can be paid after the handover of the work.

3 payment: single sub project owners and reduce staff labor relations, confirmed on arrears of wages, funds, medical expenses, shall pay. Because the employee to project owners have caused economic losses, you can deduct wages, the balance after the deduction shall not be lower than the minimum wage standard in administrative areas.

4 transfer of social insurance and Archives: a single sub project owners should be issued by the reduction of personnel to terminate the labor contract, in fifteen days for workers to file and social insurance transfer procedures.

Transfer to the social security system for the placement of unemployment insurance personnel

Urban workers

The 5 sub project owners should first receive timely for unemployment insurance will prove by staff reductions issued by the termination or rescission of the labor relation, informed of their rights to enjoy unemployment insurance benefits in accordance with the provisions, and the above list of persons from the termination or rescission of the labor within 7 days of daily social insurance agencies for the record closing date system by staff reductions shall hold the units for the certificate issued by the termination or rescission of the labor relation, in a timely manner to the designated social insurance agency for registration of the unemployed and the termination or rescission of the labor contract within 60 days to apply for unemployment insurance. The staff reductions among areas flow, unemployment insurance relationship changed move. The transition unemployment insurance relationship by reducing staff, with unemployment insurance from handling proof materials issued by the agency to immigration agencies receive unemployment insurance Dangerous gold.

Agricultural census register personnel

6 household categories for agriculture, continuous work for a full year, the unit pay the unemployment insurance premium by the reduction of personnel, sub project owners shall apply to the social insurance agency, the social insurance agency shall work according to the length of time, pay a living allowance for it.

Transferred to the social security for self occupation (self-employed) personnel placement

7 jobs belong to employment difficulties, including the age of female workers over 40 years of age, male workers over the age of 50, within the statutory labor age, with severe disabilities, are willing to apply for individual business license < >, single sub project owners in their labor relations, pay economic compensation after the guide to social security for self occupation (self-employed) social insurance subsidies.

Special personnel (workers with injury, "three period" personnel) placement

8 injured personnel cuts a written proposal and the employer voluntary dissolution or termination of labor relations, sub project owners shall pay a one-time injury Medicaid and

disability employment subsidies to workers and back injury to the < > certificate agencies for work-related injury insurance termination formalities, terminate the labor relationship in accordance with the law.

The 9 sub project owners can be negotiated with the sick period of medical treatment or work place injury, her pregnancy lactation staff in the unit of work for fifteen consecutive years and the statutory retirement age less than five years of staff labor relations, pay economic compensation according to law. If the negotiation fails, not illegal termination labor relations.

Placement of temporary labor service personnel

10 project units must establish labor protection and compensation system, given the same as regular employees or reasonable working conditions for temporary workers in the work of the unit of wages, benefits and compensation, to protect their interests.

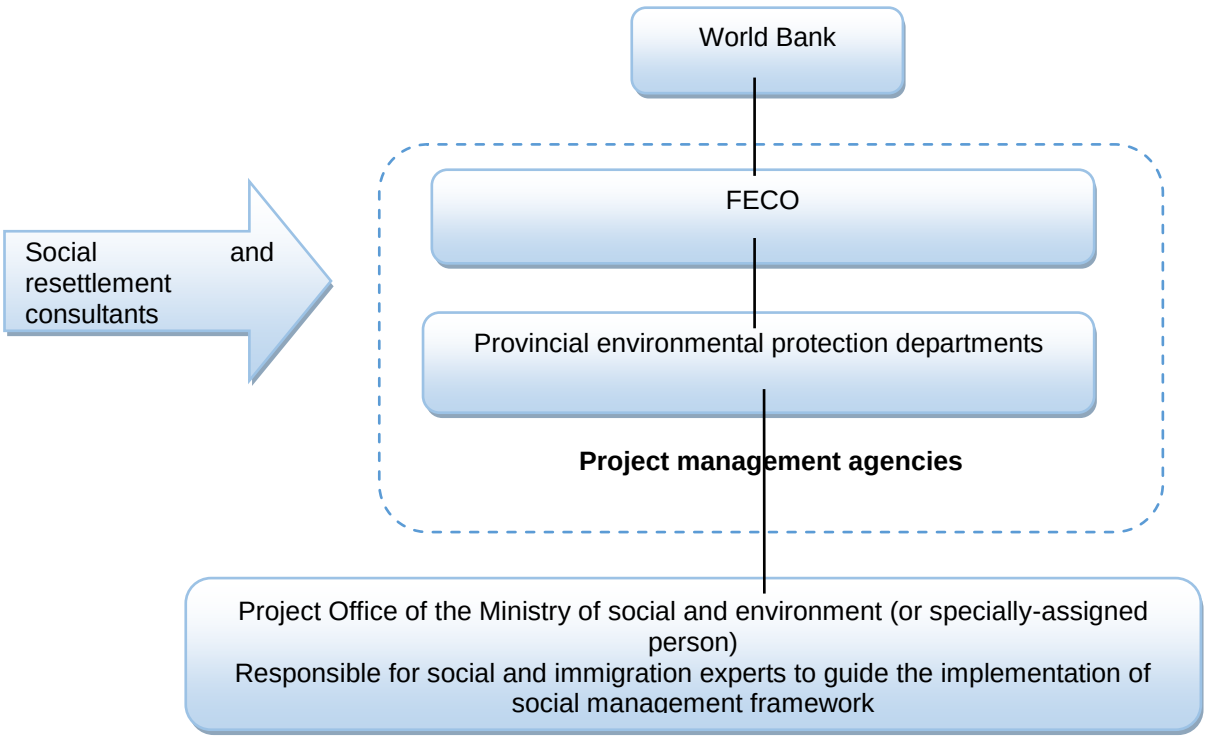
4.6. Review / approval of resettlement plan

The resettlement plan must comply with the statutory procedures China.A) the employer needs to cut down the lack of staff twenty people, workers or workers must be submitted to the Congress meeting, promptly announced to the masses of workers, fully listen to the opinions of the masses of workers, for the masses of workers the program understanding and support for security; b) the employer needs to cut down more than twenty staff layoffs or less than twenty people but accounted for more than ten percent of the number of enterprise employees, should be thirty days in advance to the trade union or all of its employees to explain the situation, listen to the opinions of the labor union or the workers, and the resettlement plan to the local human resources and social security department to implement layoffs. All the sub project resettlement plan should be reported to the local the project office.

4.7. Financial Arrangements

Funds needed for the implementation of the WRP will be from the provincial PMOs, local governments or owners mainly.

5. Organizational Structure and Capacity Building



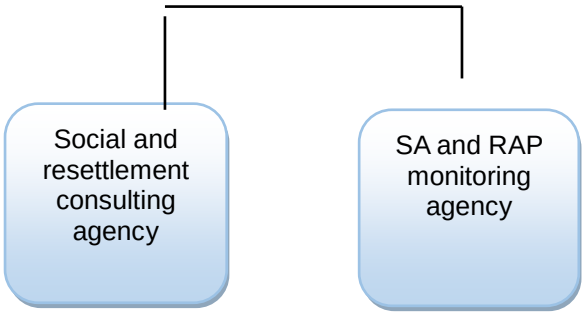


Figure 5-1 Organizational Chart for Social and Resettlement Management of the Project

Bank: supervising the implementation of social and resettlement management, and reviewing and approving the social safeguard documents

FECO and: supervising the implementation of the social safeguard documents; and reporting the same to the Bank regularly provincial PMOs and government agencies concerned (civil affairs bureaus, labor and social security bureaus, etc.): screening social risks preliminarily according to the approved SMFP, reviewing the Social Management Plan, and reporting the implementation of the Social Management Plan or RAP to FECO regularly with the assistance of the consultants or consulting agencies

Project Office of the Ministry of social and environment (or specially-assigned person)： Responsible for the implementation of the project, according to the requirements of the preparation of social management and immigration plan documents, to assist in the project verification and supervision; to the project management agencies to submit progress report

SA and resettlement consulting agencies: preparing the SA Report and RAP

SA and resettlement monitoring agencies: conducting M&E on the Social Management Plan or RAP

FECO: assisting staff to manage social and resettlement risks, and ensure that the Project is implemented as per the procedures specified in the Social Management Plan (WRP) or the RAP. In addition, FECO may appoint qualified social consultants or agencies to assist the PMOs in performing activities under the SMF, and managing social risks during project implementation.

The qualified social consultants or agencies will offer social and resettlement training to the PMOs, and social and resettlement management agencies. The PMOs will prepare and implement RAPs or SA reports (WRPs) with the assistance of the consultants.

6. Public Participation and Grievance Redress

6.1. Public Participation and Information Disclosure

The RAP and the WRP/SA report should describe the measures taken or to be taken, and enable the affected persons and workers to participate in the proposed project activities.

The RAP and the WRP/SA report should be subject to free, prior, and informed consultation, and all documents that ensure the adequate participation of the APs should be disclosed as required by the Bank.

Public participation should be implemented ahead of project design, and must run through the whole process of RAP implementation and external M&E.

During public participation, this SMF was disclosed in the affected cities and enterprises for comment.

6.2. Grievance Redress Mechanism

During project preparation and implementation, an effective grievance redress has been established in order to learn the Project's impacts on stakeholders, and ensure extensive public participation:

- **Stage 1**: An AP may file an oral or written appeal with the employer or village/community committee. In case of an oral appeal, the employer or village/community committee shall keep a written record. Such appeal should be solved within two weeks.
- **Stage 2**: If the AP is dissatisfied with the disposition of Stage 1, he/she may file an appeal with the IA or project management agency after receiving such disposition, which shall make a disposition within two weeks.
- **Stage 3:** If the AP is still dissatisfied with the disposition of Stage 2, he/she may file an appeal with the competent authorities level by level in accordance with the Administrative Procedure Law of the PRC for arbitration.
- **Stage 4:** If the AP is still dissatisfied with the arbitration award, he/she may file a suit in a civil court in accordance with the Civil Procedure Law of the PRC after receiving the arbitration award.

7. Monitoring and Evaluation

FECO should establish an M&E mechanism for the implementation of the RAP and the WRP, including internal and external monitoring.

7.1. Internal Monitoring

Internal monitoring will be implemented by FECO, which will establish a topside-down internal monitoring mechanism. FECO or the appointed consultants will monitor the implementation of the RAP and the WRP semiannually, and prepare two progress reports annually for submission to the Bank.

7.2. External Monitoring

External M&E will be conducted by an independent agency appointed by FECO or the PMOs through public bidding over all resettlement activities of the Project semiannually until project completion. Such independent agency may be an academic institution, NGO or consulting firm, but it should have qualified and experienced staff, and its TORs should be accepted by the Bank.

Appendix 1: Screening of Potential Social Safeguard Issues

The PMO will use this form to screen the applications of all components:

Basic information of component

Name of component		Component No.	
Owner		Location of component	
Estimated budget		Estimated date of commencement	
Brief description of component (including LA and HD, affected workers, etc.):			
Summary of screening results:			

List of social safeguard screening results

	Item	Yes	No	Unknown	Description	If yes, Bank policy triggered	If yes, document required
I. Resettlement and LA							
1	Will the Project lead to LA (public or private, temporary or permanent)?					OP4.12 Involuntary resettlement	RAP
2	Will the Project lead to HD (including operating and non-operating properties)?					OP4.12 Involuntary resettlement	RAP
3	Will anyone be prohibited from using its routine economic resources (e.g., pastures, fishing sites, forests)?					OP4.12 Involuntary resettlement	RAP
4	Will the Project lead to the involuntary resettlement of individuals or households?					OP4.12 Involuntary resettlement	RAP
5	Will the Project lead to the temporary or permanent loss of crops, fruit trees and facilities?					OP4.12 Involuntary resettlement	RAP

II. Workers							
8	Will the Project lead to the unemployment of workers?						Workers' reemployment plan
9	Will the Project lead to the job transfer of workers?						Job transfer training
10	Will the Project lead to the income reduction of workers?						

Signatures of screening and review staff:

Signature of the Social Officer of the PMO:

Name: _____

Title and date: _____

Signature of the Director of the PMO:

Name: _____

Title and date: _____

The PMO will keep a copy of this form and copies of related documents. A set of copies will be submitted to the Bank. If necessary, a third set of copies will be sent to the provincial authorities.

Appendix 2: TORs of the RAP

1 Basic Information of the Project
- 1.1 Background of the Project
- 1.2 Introduction to the Project
- 1.3 Components and resettlement impacts
- 1.4 Project preparation and progress
- 1.5 Measures to reduce resettlement
- 1.6 Identification of related projects

2 Impacts of the Project
- 3.1 Project impact survey
- 3.2 Range of project impacts
- 3.3 Impacts
  - 2.3.1 Acquisition of rural collective land
  - 2.3.2 Temporary land occupation
  - 2.3.3 HD
  - 2.3.4 Infrastructure and ground attachments
  - 2.3.5 Affected population
  - 2.3.6 Vulnerable groups

3 Socioeconomic Profile
- 3.1 Socioeconomic profile of the project area
  - 3.1.1 Socioeconomic profile of the affected cities and districts/counties
  - 3.1.2 Socioeconomic profile of the affected villages
- 3.2 Sampling survey
  - 3.2.1 Households affected by LA
  - 3.2.2 Households affected by HD

4 Legal Framework and Polices
- 4.1 Policy framework
- 4.2 Main principles
- 4.3 Resettlement policies of the Project
  - 4.3.1 Acquisition of rural collective land
  - 4.3.2 HD
  - 4.3.3 Vulnerable groups
  - 4.3.4 Infrastructure and ground attachments

5 Compensation Rates
- 5.1 Acquisition of rural collective land
- 5.2 HD
- 5.3 Infrastructure and ground attachments
- 5.4 Rates of other costs

6 Production and Livelihood Restoration Programs
- 6.1 Objectives of resettlement
- 6.2 Resettlement principles
  - 6.2.1 Resettlement minimization
  - 6.2.2 Equivalent compensation
  - 6.2.3 Focusing
- 6.3 Restoration program for LA
  - 6.3.1 LA impact analysis
  - 6.3.2 Analysis of lost income
  - 6.3.3 Restoration measures
- 6.4 Restoration program for HD
- 6.5 Restoration program for vulnerable groups
  - 6.5.1 Assistance measures
  - 6.5.2 Training
  - 6.5.3 Employment
- 6.6 Restoration program for ground attachments

Appendix 3: Legal Framework for RAP Implementation

Table 1 Laws and Policies on LA

Level	No.	Location	Document	Effective date
State	/	/	Land Administration Law of the PRC	2004-8-28
			Regulations on the Implementation of the Land Administration Law of the PRC (Decree No.256 of the State Council)	1998-12-27
			Measures on Public Announcement of Land Acquisition (Decree No.10 of the Ministry of Land and Resources)	2002-1-1
			Decision of the State Council on Deepening the Reform and Rigidly Enforcing Land Administration (SC [2004] No.28)	2004-10-21
			Guidelines on Improving Compensation and Resettlement Systems for Land Acquisition (MLR [2004] No.238)	2004-11-3
			Notice of the Ministry of Land and Resources on Formulating Uniform Annual Output Value Rates and Location-based Integrated Land Prices (MLR [2005] No.114)	2005-7-23
			Notice of the State Council on Intensifying Land Control (SC [2006] No.31)	2006-8-31
			Real Right Law of the PRC	2007-10-1
			Interim Regulations on Farmland Occupation Tax of the PRC	2008-1-1
Province	1	Fujian	Measures of Fujian Province for the Implementation of the Land Administration Law of the PRC	2000-1-1
			Notice of the Fujian Provincial Government on Strengthening Land Acquisition Compensation and Resettlement, and Protecting the Lawful Rights and Interests of Land-expropriated Farmers (FPG [2004] No.2)	2004-1-14
			Notice of the Fujian Provincial Government on Adjusting Land Acquisition Compensation Rates (FPG [2012] No.57)	2012-12-7
	2	Hubei	Measures of Hubei Province for the Implementation of the Land Administration Law of the PRC	2010-7-30
			Notice of the Hbei Provincial Government on Strengthening Land Acquisition Compensation and Resettlement, and Protecting the Lawful Rights and Interests of Land-expropriated Farmers (HPG [2005] No.11)	2005-2-27
			Notice of the Hbei Provincial Government on Disclosing Uniform AAOV Rates and Location-based Land Prices for Land Acquisition of Hubei Province (HPG [2014] No.12)	2014-4-1
	3	Jiangxi	Measures of Jiangxi Province for the Implementation of the Land Administration Law of the PRC (2000)	2001-4-29
			Administrative Measures for the Levy of Farmland Occupation Tax (Interim) (Jiangxi Provincial Local Taxation Bureau)	2011-6-1
			Notice of the Jiangxi Provincial Government on Adjusting Uniform AAOV Rates and Location-based Land Prices for Land Acquisition (JPG [2015] No.81)	2015-9-1

Table 2 Laws and Policies on HD

Level	No.	Location	Document	Effective date
State	/	/	Regulations on the Expropriation of Buildings on State-owned Land and Compensation Therefor (Decree No.590 of the State Council)	2011-1-21
Province	1	Fujian	Measures of Fujian Province for the Implementation of the Regulations on House Acquisition on State-owned Land and Compensation	2014-3-20
			Notice of the Fujian Provincial Government on the Rates of Moving and Transition Subsidies for Urban House Demolition (FPG [2002] No.26)	2002-6-24

Level	No.	Location	Document	Effective date
	2	Hubei	Measures of Hubei Province for the implementation of House Acquisition on State-owned Land and Compensation	2015-7-6
	3	Jiangxi	Measures of Jiangxi Province for the implementation of House Acquisition on State-owned Land and Compensation	2014-12-5

Appendix 4: Sample Entitlement Matrix

Type	APs	Measure	Entitlement
LA	Village collectives	1) Collective land	Compensation will be fully paid to the village collective, and used through discussion at a village meeting.
		2) Attachments	
	Rural residents	1) Land compensation and resettlement subsidy	Households not subject to land reallocation will receive 80% of land compensation.
			For households subject to land reallocation, land compensation and resettlement subsidy will be disbursed to each affected group for even distribution.
		2) Temporary land use	Full compensation for temporary land use will be paid based on the period of use, and the used land will be fully restored after use.
		3) Young crops	The direct APs will receive full young crop compensation.
		4) Social insurance	Eligible farmers may cover social insurance.
		5) Production and livelihood measures	Free training and job referral will be offered to LEFs.
HD	Rural residents	Compensation and resettlement	1) The AHs may choose cash compensation or property swap; 2) In case of property swap, the displacer will offer resettlement housing and supporting facilities; 3) In case of cash compensation, compensation will be paid at replacement cost, and free housing land will be provided by the local government for house reconstruction.
		Moving and transition subsidies, and reward	The AHs are entitled to moving and transition subsidies, reward, and smooth transition.
		Trees and attachments	Affected trees and attachments will be compensated for at the specified rates.
Entities	Proprietors	Compensation and resettlement	1) The affected entities may choose cash compensation or relocation; 2) In case of relocation, the displacer will assist in finding land and grant compensation at replacement cost; 3) In case of cash compensation, the affected entities will receive compensation at replacement cost; 4) The affected entities will receive compensation for production suspension or losses.
		Workers	The affected workers will receive compensation for lost income; the workers of any entity not to be relocated will receive training and job referral.

Type	APs	Measure	Entitlement
Vulnerable groups	All affected vulnerable groups	1) They will receive compensation for LA and HD equally; 2) During detailed planning, they will be further identified, and those losing contracted land will be entitled to the reallocation of resources equally; 3) They will receive assistance in production and livelihood development; 4) Poor households affected by HD will receive support from local governments during house reconstruction; 5) Local civil affairs bureaus have included five-guarantee households, the disabled, the poor and women-headed households in the local MLS system; 6) They will enjoy priority in local characteristic industry development and cooperative operation; 7) Vulnerable households short of labor will have priority in land reallocation to ensure income.	
Women	All affected women	1) All village committees should have female members, and women will enjoy the same rights as men at village meetings and congresses; 2) Women's opinions are learned and considered in public opinion surveys; 3) Women enjoy equal rights in future compensation for LA and HD; 4) Jobs generated by the Project will be first made available to women, and women will also receive training and job referral.	
Ethnic minorities	All minority APs	1) They will have priority in employment and skills training; 2) hey will have priority in receiving employment information; 3) They can express their opinions and needs at consultation meetings; 4) Relevant policies should be translated into minority languages for easier acceptance and understanding, and explained in detail; 5) Special attention will be paid to vulnerable groups in minority areas during resettlement.	
Infra-structure	Proprietors	Restored by the owner or compensated for at replacement cost	1) Some affected infrastructure will be demolished and restored by the construction agency, such as rural roads and agricultural canals. 2) Proprietors of some infrastructure may reconstruct infrastructure using compensation, such as communication and power facilities.

Appendix 5: Basic Information of Affected Enterprises

No.	Legal representative	Enterprise	Contact info	Main business line	Workforce	Gender		Status		Type of work					Covered by unemployment insurance
						Male	Female	Regular	Non-regular	Managers	Technicians	Skilled workers	Unskilled workers	Other	
1															
2															
3															
4															
5															
Subtotal															

Appendix 6: Legal Framework for the Workers' Resettlement Plan

Type	Policy/regulations	Contents and key points
Workers' resettlement	Labor Contract Law of the PRC (Order of the President No.65); Decision of the Standing Committee of the National People's Congress on Amending the Labor Contract Law of the PRC (Order of the President No.73); Notice of the Ministry of Human Resources and Social Security on the Regulations on Workforce Reduction for Enterprises (Draft for Comment); Employment Promotion Law of the PRC (Order of the President No.70); Social Insurance Law of the PRC (Order of the President No.35); Enterprise Bankruptcy Law of the PRC (Order of the President No.54); Decision on Amending the Trade Union Law of the PRC (Order of the President No.57); Trade Union Law of the PRC (Order of the President No.8); Opinions of the State Council on Doing a Better Job in Employment and Business Startup in the New Situation (SC [2015] No.23); Opinions on the Proper Resettlement of	1) Units shall establish and improve labor rules and regulations, so as to ensure that labor rights of the laborers are safeguarded and laborers perform according to their labor obligations. When a Unit formulates, revises or decides on rules and regulations or material matters that have a direct bearing on the immediate interests of its laborers concerning labor remuneration, working hours, rest and vacations, occupational safety and health, insurance and welfare, employee training, working discipline or work quota management, etc. the same shall be discussed by the assembly of laborers' representatives or all the laborers. The assembly of laborers' representatives or all the laborers, as the case may be, shall put forward a proposal and comments, whereupon the matter shall be determined through negotiations with the labor union or employee representatives conducted on a basis of equality. 2) The State shall establish a social insurance system consisting of a basic old-age insurance, basic medical insurance, work injury insurance, unemployment insurance, and maternity insurance to guarantee citizens' rights to receive material assistance from the State and society according to law upon old age, sickness, work injury, unemployment and maternity. 3) Where the labor contract is dissolved according to law, the employer shall pay economic compensation to the labor. The laborer shall carry out the handover of his work as agreed by the parties. If the employer is required to pay economic compensation, it shall pay the same to the laborer upon completion of the procedures for the handover of the work. 4) Workers of enterprises eliminating backward production facilities, and merged and reorganized enterprises shall be resettled properly by the government and enterprises jointly, and an orderly, smooth and efficient working mechanism established; internal job transfer shall be combined with social reemployment to resettle workers through multiple channels. 5) Employment and social security policies shall be implemented properly, and effective measures taken to handle living security, labor relation handling, employment skills training, reemployment support, social insurance continuation and transfer, and outstanding issue solving for workers properly, thereby protecting the rights and interests of workers effectively. 6) Dispatched laborers shall have the right to receive equal pay for equal work as other laborers in the employer. If a Unit to which a laborer has been dispatched has no other laborer in the same position, the labor remuneration shall be determined with reference to the labor remuneration of laborers in the same or similar position where the employer is located. 7) Various measures should be taken to resettle workers of enterprises eliminating backward production facilities, and merged and reorganized enterprises properly, including reemployment promotion, proper social insurance continuation and transfer, proper labor relation handling, and more effective occupational training. 8) If an enterprise is to reduce its workforce according to law, it

Type	Policy/regulations	Contents and key points
	Workers of Enterprises Eliminating Backward Production Facilities, and Merged and Reorganized Enterprises (MHRSS [2011] No.50)	shall consult with the trade union or workers' representatives in advance to minimize workforce reduction. If workforce reduction is inevitable, it may be minimized by such means as job transfer training and skill improvement.
Protection of women's rights and interests	Labor Law of the PRC	1) Females shall enjoy equal rights as males in employment. It shall not be allowed, in the recruitment of staff and workers, to use sex as a pretext for excluding females form employment or to raise recruitment standards for the females, except for the types of work or posts that are not suitable for females as stipulated by the State. (Article 13 of the Labor Law of the PRC) 2) The employer shall not revoke labor contracts with female workers during pregnant, puerperal, or breast-feeding period. (Article 29 of the Labor Law of the PRC) 3) The State shall provide female workers and juvenile workers with special protection. It is prohibited to arrange female workers to engage in work down the pit of mines, or work with Grade IV physical labor intensity as stipulated by the State, or other work that female workers should avoid. Female workers during their menstrual periods shall not be arranged to engaged in work high above the ground, under low temperature, or in cold water or work with Grade III physical labor intensity as stipulated by the State. Female workers during their pregnancy shall not be arranged to engage in work with Grade III physical labor intensity as stipulated by the State or other work that they should avoid in pregnancy. Female workers pregnant for seven months or more shall not be arranged to extend their working hours or to work night shifts. (Articles 58-61 and 63 of the Labor Law of the PRC) 4) Where an employer encroaches upon the legitimate rights and interests of female and juvenile workers in violation of the stipulations of this Law on their protection, the labor administrative department shall order it to make corrections, and impose a fine. If harms to female and juvenile workers have been caused, the unit shall assume the responsibility for compensations. (Article 95 of the Labor Law of the PRC)
Hubei Province	Measures for the Implementation of Unemployment Insurance of Hubei Province; Regulations of Hubei Province on Labor Contract; Opinions of the Hubei Provincial Government on Doing a Better Job in Employment and Business Startup in	1) An active unemployment insurance policy shall be practiced to grant subsidies for workforce stabilization at not more than 50% for unemployment insurance premiums. In areas where the balance of the unemployment insurance fund is large, part of the fund may be used for secured loans for business startup provided insurance benefits are paid timely and fully. 2) Rewards for eliminating backward production facilities, and land compensation paid to enterprises under merger and reorganization policies shall be first used for worker resettlement. A sound unemployment monitoring and early warning mechanism shall be established to respond to unemployment risks. 3) Employment assistance for residents with difficulty: The scope of residents with difficulty in employment shall be

Type	Policy/regulations	Contents and key points
	the New Situation (HPG [2015] No.46)	determined rationally and normatively to ensure that at least one member of each zero-employment or MLS household is employed. If market-based employment is difficult, one may be placed to a public welfare job offered by the government, and receive a certain social insurance subsidy for a certain period. 4) Vocational and business startup training: Vocational training shall be offered on a large scale, and in innovative ways to cover e-commerce, housekeeping, old age services, etc. Enterprises shall be encouraged to recruit young and reemployed laborers for apprentice-type training. 5) A mechanism of coordination between employment and social security shall be established. If an unemployed resident starts up a business when receiving unemployment insurance benefits, he/she may receive the full amount of benefits at a time with the business license. For any subject of MLS getting employed or starting up a business independently, his/her household income shall be calculated net of necessary employment or startup costs; if the per capita income of a household seeking employment actively exceeds the local MLS standard, it shall continue to receive the MLS subsidy for not more than 3 months; the MLS subsidy shall be granted to any middle-aged and old, underage, or severely disabled or sick member for a certain period; if the per capita income of a household does not exceed 1.5 times the local MLS standard after independent employment, the coverage may be extended for one year.