



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

**Environmental & Social Management  
Framework ( updated version after  
restructuring )**

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**Foreign Environmental Cooperation Center, Ministry of  
Ecology and Environment (FECO)**

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## 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 Environmental Cooperation Center
HAES	Hubei Academy Environmental Science
PID	Project Information Document
PMO	Project Management Office
NPMO	National Project Management Office
PPMO	Provincial Project Management Office
TOR	Terms of Reference
ESMF	Environment and Social Management Framework
PIU	Project Implementation Unit
PMP	Pest Management Plan
ESMP	Environment and Social Management Plan
AH	Affected Household
AP	Affected Person
RAP	Resettlement Action Plan
BP	Bank Procedure
FGD	Focus Group Discussion
HD	House Demolition
LA	Land Acquisition
M&E	Monitoring and evaluation
OP	Operational Policy
PRC	People's Republic of China
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SA	Social Assessment

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## **Part I Environmental Management Framework**

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# 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 added 9 POPs to the list. 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 6 exempt uses of PFOS before the exemption expires on March 25, 2019, and conduct BAT/BEP in the seven PFOS-related industries which use PFOS for 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 Environmental Cooperation Center (FECO) and World Bank (WB) are developing the "GEF-Reduction and phase-out of PFOS in priority sectors in China". On June 4, 2015, the project concept obtained the approval of GEF. The project is about chemicals management aimed at helping China fulfill its obligations in phasing out of PFOS and its salts, as is stated in Stockholm Convention on POPs. The total investment of the project is \$ 67.22 million, of which GEF grant is \$ 24.25 million.

The proposed adjustments to the project design are required to adapt to changes in government policies and to the evolving priority sectors. Since the project was appraised in 2017, several new policies on PFOS use were promulgated by the Government of China (GoC). For example, the Ministry of Ecology and Environment (MEE) released a joint statement with multiple ministries on March 11, 2019, banning the use of PFOS other than "acceptable use" after March 26, 2019. Due to strong environmental supervision from 2016, the main PFOS and primary product manufacturers are no longer able to maintain production, and also face higher environmental protection requirements in the process of conversion. As a result, a number of potential demonstration enterprises have moved out of PFOS production ahead of the project (Component 1). Furthermore, the number of firms participating in demonstration activities under Component 2 have also been much lower than anticipated. Considering the transaction cost of joining the project and limited incentives, very few enterprises have expressed interest to participate in the demonstration of non-PFOS Chromium Mist Suppressants (CMS) alternatives and Chromium (III) technology. Thus, the mid-term restructuring of the project has been started, and some activities have been adjusted, involving the following changes: (i) changes to project components and costs, such as the removal of select activities that are no longer relevant; (ii) reallocation of funding and incorporation of new activities in project; (iii) subsequent amendments to the results framework.

## 1.2 Objectives

The environmental safeguard policies of World Bank are applicable to all project activities under the project, [including the activities added during mid-term-restructuring](#), regardless of using domestic counterpart fund or other sources. Based on analyzing the range and degree of potential environmental impacts, this project is identified as a category A project under World Bank safeguards categorization.

The content of demonstration project can only be determined during implementation, so we formulate the Environmental and Social Management Framework (ESMF) to guide PMOs at each level in screening and assessment of environmental impacts. The ESMF 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

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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 standards of screening demonstration projects, responsibilities during preparation and implementation phases, work to be done and related requirements.

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## Chapter 2. Project Description

The Global Environmental Objective (GEO) of the proposed project is to help China with PFOS production and emission reduction in application industries. Through the implementation of the project, PFOS will be reduced by at least 44 tons in production and application, significantly reducing the emission of POPs, reducing environmental risks. Additionally, the supervision capacity of relevant management agencies and public awareness of reducing POPs will be enhanced, bringing positive environmental benefits. The project mainly includes PFOS production industry, application industry in electroplating, red imported fire ants (RIFA) prevention and firefighting. [In 2021, the project undertook a mid-term review, and as a consequence, a project restructuring is proposed to adjust some activities. The following description reflects these proposed adjustments.](#)

Specifically, it includes four components:

### ***Component 1: PFOS Production Reduction***

This component is mainly carried out in Hubei and Fujian, and will support production phase-out and reduction for primary PFOSF producers and at secondary PFOS producers. Activities to be financed include: closure; conversion of production to non-POPs like chemicals.

*Conversion of production facilities:* This component will finance conversion of PFOSF production facilities and offer incentives to support downstream PFOS manufacturers in switching to new non PFOS-based products. The project would not finance any production of chemicals known to possess persistence, bio-accumulative and toxic (PBT) characteristics. Eligible incremental expenditures would include: (a) development of non-PFOS products; (b) costs related to registration of new products; (c) equipment and technology transfer costs; (d) installation of equipment; (e) training; (f) trial production; (g) incremental costs of new raw materials, utilities, waste management; and (h) costs of disposal of contaminated equipment previously used for producing or storing PFOS.

*Plant or production line closure:* GEF incremental support would be extended to enterprises that might decide to close down their production facility altogether. GEF resources will be used to support management of environmental liabilities from such closure. Eligible incremental expenditure would include: (a) dismantling costs; (b) disposal costs of contaminated equipment and materials; and (c) consulting services to develop site risk assessment, management and monitoring plans. Remediation beyond disposal of contaminated equipment is expected to be financed by other sources outside of the Project.

[Considering the current situation of China's existing production enterprises, some original activity categories have been deleted in the restructuring process, but the activity contents of the remaining activities have not been changed.](#)

### ***Component 2: Reduction of PFOS Use***

This component is mainly carried out in Guangdong and Hubei and addresses three priority sectors: chromium mist suppressants in the metal plating sector, firefighting foam sector, and pesticides for control of red imported fire ant (RIFA). The fourth large sector in terms of consumption, oil production, is addressed through TA only under component 3.

*Chrome mist suppressant in metal plating:* The Project will finance demonstration activities to showcase closed-loop systems, with equivalent or improved efficacy in terms of protection of human health and safety. The demonstration activities include installations of approx. two

closed-loop systems, and the industrial parks will be selected during the project implementation. Criteria for selection of these industrial parks would include the number of chrome plating enterprises, environmental management capacity of the industrial parks, and willingness to showcase demonstration activities to similar industry in other industrial parks.

The project will finance costs in relation to acquiring of the following: (a) upgrade of facilities to closed-loop systems; (b) chrome plating baths replacement; (c) new chromium mist suppressant; (d) other equipment, testing device, and control systems related to the use of new alternatives; (e) ventilation and safety equipment; (f) site preparation for installation of new equipment; (g) advanced treatment facilities for up to three industrial parks for removing perfluorinated compounds (PFCs) from water discharge from chrome plating industry.

*Firefighting foam:* The project will finance development and production of non-PFOS firefighting foam at 3-5 firefighting foam manufacturers. The selection criteria of firefighting foam manufacturers would include: (a) research and development capacity; (b) relevant experience with firefighting chemicals; (c) large network of firefighting foam clients; (d) good environmental performance record; (e) in-house capacity to develop non-PFOS surfactants or technical cooperation with reputable surfactant manufacturers; and (f) cost effective proposals.

The following costs will be covered by the Project: (a) research and development of new non-PFOS based firefighting foam; (b) environmental and health impact evaluation of new alternatives; (c) new equipment for manufacturing non-PFOS based firefighting foam; (d) site preparation for installing new equipment; (e) tanks and storage facilities; (f) testing efficacy of new products; and (g) registration of new surfactants and firefighting foam. In addition, financing costs of new non-PFOS firefighting foam needed for training at 3 training facilities of the public security ministry could be supported, as well as costs of firefighting equipment retrofit or procurement of new equipment, together with facilities for facilities treatment of wastewater discharge.

*Pest control:* The project will finance procurement of pesticides (9 tons total: 6 tons of indoxacarb based baits, 3 tons of cypermethrin based powder, and a small amount of hydramethylnon) for demonstration of a two-phase treatment method using bait and powder to control red fire ants, carried out under component 3.

Disposal of wastes containing PFOS (new activities): [due to the active steps to implement the Stockholm Convention](#), PFOS has been banned from use in the open system of metal plating (CMS), pesticide and other industries. The project will demonstrate the collection and disposal of PFOS containing CMS waste in some key provinces. At the same time, taking into account the exemplary role of the project, the PFOS project will also demonstrate the disposal of some expired PFOS containing fire foam concentrate as hazardous waste. The specific list of new activities is as follows:

Component	Name of new activity	Activity description
Part 2: Reduction of PFOS use	Waste disposal of PFOS-containing foam extinguishing agent	The contractors (hazardous waste disposal units) should collect the foam extinguishing agent from production enterprises serving as the collection nodes and transport and dispose of the PFOS-containing wastes. PFOS-containing foam is expected to be no less than 100 ton, while activities are expected to be held in Shanghai,

		Zhejiang, Jiangsu and Henan provinces.
	Waste disposal of PFOS-containing chromium mist suppressant	The contractors (hazardous waste disposal units) should collect the CMS from metal-plating enterprises and industrial parks as the collection nodes and transport and dispose the PFOS-containing wastes harmlessly. PFOS-containing CMS is expected to be around 1-2 tons, while activities are expected to be held in Guangdong and Hubei provinces.
	Testing capability building in Guangdong Province	Purchase testing equipment, train related technical personnel, and strengthen laboratory testing capability.

Except for these new activities, only some categories of activities have been deleted in this part (demonstration of CMS alternatives and of Cr(iii) technology), and the specific content of the original activities have not been changed.

**Component 3: Policy and Technical Assistance**

This component is carried out in Hubei, Fujian, Guangdong, Guangxi, Guizhou and Hainan Province, with addition of Jiangxi and Yunnan, and will finance technical assistance activities required to strengthen regulatory and policy framework, standards, and capacity building. These activities are essential for ensuring sustainability of PFOS phase-out in both production and consumption sectors. TA activities include:

*Standards and Regulations:* The Project will carry out activities to develop industry standards, good practices, and regulations to support introduction of non-PFOS alternatives. Supported activities would include: (a) labeling scheme to ensure that commercially available chromium mist suppressant will have to be properly labeled; (b) development of technical specifications for chromium mist suppressants, including efficacy in protecting human health and safety; (c) standards defining PFOS waste, and related best practices for disposal; specification of discharge of wastewater containing PFOS for electroplating industry in Guangdong province; (d) development of guidelines for cleaner production for organofluorine manufacturing industry; (e) revision of cleaner production audit indicator system for electroplating industry to include PFOS in Guangdong Province; (f) technical report on efficacy of non-PFOS based pesticides for controlling red imported fire ant; and (g) development of guidelines for green procurement for the oil sector.

*Screening of non-PFOS Alternatives:* To ascertain that new non-PFOS alternatives to be introduced in China should not have PBT characteristics, a PBT screening system for new chemicals will be established. Supported activities include: (a) guidelines for registration of new chemicals including reporting requirement on PBT characteristics; (b) development of standard testing protocol for determining PBT characteristic of organofluorine chemicals; and (c) screening reports on PBT characteristics of at least 10 non-PFOS chromium mist suppressants.

*Technical Studies:* A series of studies will be carried out under the project to enhance understanding of PFOS use as CMS in electroplating factories in Guangdong province. To guide the chrome plating industry in the future as part of the efforts to sustain achievement of this project, the Project will finance the testing of mist suppression performance of alternatives and develop a list of acceptable chromium mist suppressants. A preliminary

study will also be conducted on health impacts of PFOS in China as a first step to scoping and better understanding the issue.

*Technical Assistance to Eliminate the Use of PFOS in Firefighting:* The project will support testing the safety and efficacy of alternative non-PFOS firefighting foams and products; devising technical way forward for substitution of PFOS in the firefighting sector; revising relevant standards as needed; capacity development to detect PFOS substances in foam extinguishing agents; and strengthening the tracking and control of PFOS containing firefighting agents. Since a large quantity of PFOS firefighting foam is used for training, adopting new non-PFOS alternative foam could lead to permanent reduction of a significant quantity of PFOS. The project would therefore finance revision of firefighting protocols and training manuals for effective use of new non-PFOS firefighting foam without compromising safety and health of firefighting cadets.

*Technical Assistance to Eliminate the Use of PFOS for control of RIFA:* Demonstration of alternative pest management techniques and practices will be conducted in Fujian, Guangdong, Guangxi, Guizhou, Hainan and newly added Yunnan, Jiangxi. The project will cover costs related to the ‘training of trainers’ program that will involve ‘training schools’ in the 7 demonstration provinces and up to additional 7 provinces. Participants will include county, municipal and provincial level practitioners.

*PFOS Registration and Reporting System:* The project will strengthen capacity of Ministry of Ecology and Environment (MEE) and local Ecology and Environment Bureaus (EEBs) to enforce regulations and monitoring requirements for hazardous substances. A tracking system will be developed to support registration of producers of PFOSF, secondary PFOS based product manufacturers, and users of PFOS products in firefighting foam industry, and mainstreamed in the in the National POPs Chemical Survey and Reporting Information System. The system will assist China to monitor production and supply of PFOS materials from sources to end users. Technical capacity of local EPBs will be strengthened to enable them to carry out or supervise factory audits to prevent any diversion of PFOSF to banned applications. Efforts would mainly focus on strengthening capacity of local EPBs in Fujian and Hubei to control the PFOS supply chain.

There are no major changes in the above activities. In addition, the project will carry out a series of additional policy and technology research. The specific new activities are listed as follows:

Part 3: Policy and technical assistance	New red imported fire ant demonstration areas	Two new red imported fire ant demonstration areas in Jiangxi and Yunnan should be constructed according to the same scheme and technology in the existing demonstration areas, i.e., by using hydramethylnon, beta-cypermethrin and indoxacarb to replace sulfluramid.
	Research on high-temperature incineration technology for PFOS disposal	Launch the demonstration of high-temperature incineration for typical PFOS-containing wastes. Research the mass balance and PFOS removal rate in the PFOS-containing waste incineration process. Clarify the technical requirements on high-temperature incineration of PFOS-containing wastes

		in China; evaluate pollutant emission in the process of high-temperature incineration of PFOS-containing wastes. The activity is expected to be launched in Liaoning Province. This technical research is expected to use 10kg of PFOS-containing products, including 4kg of chromium mist suppressant and 6kg of PFOS-containing foam extinguishing agent.
	Research on the adaptation of existing domestic regulations and policies to the 2019 amendment to the Stockholm Convention	Review domestic regulations, policies and technical standards related to fire-fighting foam; and with the combination of the requirements for restriction in the amendment, carry out literature review, field research and expert review, so as to summarize the policies and standards that need to be revised in China and complete policy recommendations. Investigate and review foreign and related policies and regulations, technical standards, and researches on management experience.
	Formulation of the group standard concerning the rapid testing equipment for PFOS in fire extinguishing agent	Launch the formulation of the group standard concerning the rapid testing equipment for PFOS, and promote the release of group standards. Formulate the PFOS rapid testing equipment certification rules, launch the pilots for the PFOS rapid testing equipment certification and the verification of PFOS rapid testing methods for fire extinguishing agent.
	Study on environmental quality standard of fluorinated compounds in drinking water	Combined with literature research, study the reasonable limit value of fluorinated compounds in drinking water, to provide technical support for subsequent relevant standards compilation.
	Study on screening values of typical fluorinated compounds in contaminated sites	Conduct the research on screening values of typical fluorinated compounds in contaminated sites combined with literature research and on-site study.

Regarding, PFOS high temperature incineration disposal technology evaluation, it is to be organized and implemented by scientific research institutions. The following core objectives are to be achieved: (1)

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demonstration of high temperature incineration of typical PFOS containing wastes; (2) research on the mass balance and removal rate of PFOS in the incineration process of PFOS containing wastes; (3) clarification of the technical requirements for high temperature incineration of PFOS containing waste in China; (4) evaluation of the pollutant emission of PFOS containing waste during high temperature incineration. In order to achieve the above objectives, it is planned to select appropriate incineration facilities to carry out high-temperature incineration test. Based on technical documents such as *technical specifications for performance test of hazardous waste incineration and disposal facilities*, it is proposed to guide the assessment of incineration removal rate and other work, while basing on guidelines such as *pollution control standard for hazardous waste incineration* to assess the pollutant emission in the process of disposal. According to the requirements of the project, the disposal effect, pollutant emission and key operation parameters of PFOS containing waste high-temperature incineration process will be studied to ensure the implementation effect of the project.

***Component 4: Project management***

Component 4 will finance: (i) costs of operations of three project management offices (PMOs) at FECO, Guangdong EEB and Hubei EEB, as well as (ii) Monitoring and Evaluation. Eligible costs include expenditures incurred by the PMOs in carrying out the Project.

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## Chapter 3. Main Processes and Its Environmental Impact

Current studies suggest that PFOS, though with low volatility, has caused global pollution. Research has shown that PFOS-containing components enter the atmosphere and decompose to generate PFOS when diffusing globally or entering specific environments. PFOS is very stable. It won't hydrolyze or photolyze 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

Electrochemical fluorination (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:



Fluorine-containing wastewater and waste gas are the main environmental pollutants of the PFOS production industry; moreover, the wastewater contains pollutants such as COD,  $\text{NH}_3\text{-H}$  and chloride, while waste gas contains pollutants such as HCl, fly ash and  $\text{SO}_2$ . In addition, there are also distillation residue of PFOS production,  $\text{CaF}_2$  residue from wastewater treatment and other hazardous solid wastes.

In terms of the PFOS manufacturing companies, depending on the new compounds that would be produced, there is potential to generate new water pollutants and air pollutants which may bring environmental risks. In addition, environmental risks may arise during product conversion 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.

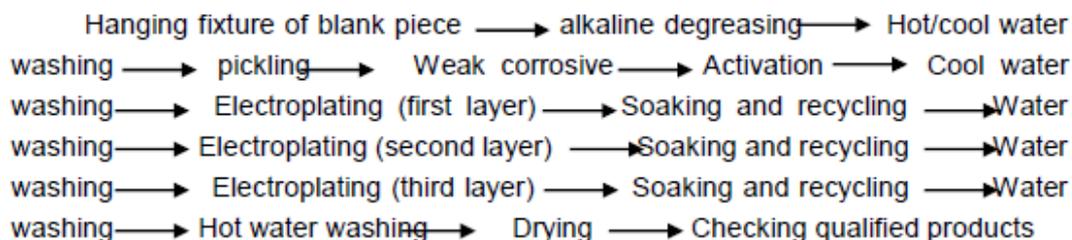
### 3.2 Environmental impact of PFOS application industries

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

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### 3.2.1 Application in electroplating

The processing of electroplating is summarized as below:



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

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. PFOS can make the surface of the bath solution form a dense foam layer to limit the overflow of CrO<sub>3</sub>. In this way, the loss of raw material is significantly reduced, and the physical nature

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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 bioaccumulation, PFOS's negative impacts on environment cannot be ignored. Therefore, PFOS needs to be phased out, replaced and treated. In the project, alternative processes of PFOS may include the following 2 schemes or technical routes:

**Firstly, the closed loop chrome plating process:**

The closed loop process is referring to that the plating solution, chromium mist, and flushing water will be recycled in the system without being discharged or exposed to workers. The pollutant containing cleansing water will be a replenishment of plating liquid solution without being discharged, thus achieving both the material balancing and water balancing together. In this process, there will be no need for chromium mist suppressant (CMS) thus eliminate the use of PFOS as CMS.

**Secondly, upgrade electroplating wastewater treatment to remove PFOS:**

The end processing of electroplating wastewater are mainly chemical method (Alkaline chlorination method, chemical reduction method, chemical precipitation method, chemical method+ membrane separation method), physical method (Ozone treatment technology, electrolysis, electrolysis + membrane separation), bio-chemical method and reverse osmosis (RO) technology. The PFOS can be removed through mainly upgrading the existing end-processing of electroplating wastewater with activated carbon or reverse osmosis advanced treatment technology. The processing briefly is as follows: use high-pressure pump to apply pressure on the side of concentrated PFOS containing solution which is higher than natural osmotic pressure, so as to revert direction of flow. In this way, the concentrated solution will penetrate through the semipermeable membrane to be purified to the side of diluted solution. The processing includes discal filter, precision filter, microfiltration and ultrafiltration and reverse osmosis, etc. After the RO process the clean water can be reused in the production process while the concentrates will be further treated with advanced technologies, such as the electrocoagulation method, or sent to specialized handling and disposal facility for disposal.

### **3.2.2 Application in pesticides**

As a kind of pesticide substance, PFOS is mainly used in China for red imported fire ant (RIFA) control, which is also a demonstration area in the project. RIFA 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) has 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, bioaccumulation, and toxicity. Meanwhile, in its application process, improper operation may produce pesticide poisoning risk; moreover, as discarded pesticides belong to hazardous waste, improper disposal will result in water/soil pollution.

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Two new demonstration areas of RIFA were added in this restructuring, and the pesticides and technical routes in the new demonstration area were consistent with those in the original demonstration area, so the environmental impact of the new activities remained unchanged

### **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 firefighting foam, and improving its liquidity and phase permeability. During production of fire-extinguishing foam, it will generate alkaline wastewater, acid washing wastewater, raw material wastewater, ground flushing water, etc. The main pollutants of wastewater include phenolic preservatives, surfactants, PFOS and PFOA. However, PFOS/PFOA is one of the most difficult organic pollutants to be degraded. It will accumulate in the environment, human bodies and animals to enter into the food chain, producing long-term potential hazards to the human health and environment.

With the R&D, technical upgrading and replacement of raw materials for new-type foam extinguisher and fire extinguisher without PFOS raw materials being applied in large-scale physical experiments, there will be positive environmental impacts by the reduction of PFOS and less discharge of persistent organic pollutants. The R&D and application of special obsolete foam (without PFOS) extinguisher for fire drills will reduce the discharge of PFOS pollutants.

For the foam extinguisher for fire drills and obsolete PFOS-contained fire extinguisher, PFOS will remain in the natural environment along with the residues of foam extinguisher and may flow into the surface water or underground water along with fire control water. As a result, it is not only a waste of resources, but also an increase of pollutants. According to the statistics, the quantity of PFOS in the surrounding water body of fire drills are quite high (more than  $2.2\mu\text{g/L}$ ) and descends gradually to the surroundings, indicating the foam extinguisher is polluting the surrounding water body. PFOS and PFOA of water body will be absorbed by crops and wild plants through irrigation or penetration into the soils on the river bank, affecting the health of humans and animals indirectly.

### **3.3 Environmental impacts of the newly added activities**

Among the restructured activities, the technical scheme and implementation plan for the construction of the two newly added demonstration zones of Red Imported Fire Ants in Jiangxi and Yunnan are consistent with the original demonstration zones. Therefore, the newly added Red Imported Fire Ants demonstration zones in the restructured activities will continue to follow the requirements of this ESMF to conduct environmental and social safeguard management and implement the Pest Management Plan that was developed. In addition, all the activities except the PFOS containing waste disposal technology appraisal, PFOS containing foam fire extinguishing agents and the waste collection and disposal of chromium mist suppressant are all activities of policy research consultation services or hardware procurement, without direct impacts on the environment. Therefore, the environmental impacts of the newly added activities in this ESMF will mainly focus on the environmental and social impacts of the PFOS containing waste disposal technology appraisal, PFOS containing foam fire extinguishing agents and the waste collection and disposal process of chromium mist suppressant. Pertaining to the other activities such as the firefighting testing, firefighting training bases and demonstration enterprises and so on, they will continue to follow the requirements of the ESMF to conduct environmental and social safeguard management.

PFOS containing waste disposal and technology appraisal are mainly related to the storage, transportation and disposal of two major types of wastes, including (1) The foam fire distinguishing agent concentrate containing PFOS is liquid, with moisture content over 60%,

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which does not have volatile gases, irritation gases, or heavy metal ingredients. The contents in the formula of the waste liquid are fluorocarbon surfactants, hydrocarbon surfactants, solvents and stabilizers and other auxiliary materials, with 0.5-0.8% of PFOS. According to the classification in the Identification Standards for Hazardous Wastes - Identification for Toxic Substances Content, the foam fire distinguishing agent with PFOS is not hazardous waste. The project will proper improve the standards, and the foam fire distinguishing agent will be treated in an environment sound way according to the national hazardous waste disposal standards and include it in the closest hazardous waste category according to the National Catalogue of Hazardous Wastes, namely, the hazardous wastes categories of HW06 waste organic solvents and wastes containing organic solvents, as well as the HW45 wastes containing organic halogenated matters; and (2) It is mainly the Potassium perfluorooctane sulfonate, perfluorooctyl tetraethyl ammonium that contain PFOS chromium mist suppressant, and the content ratio in these two types accounts for over 95%, all being white powder solids with stable property, but without volatile gases, irritation smells in normal storage, which can be stored in normal temperature. PFOS has been listed into the Catalogue of Hazardous Chemicals with the sequential NO. 1715-1722, but not yet listed into the Annex to the Identification Standards for Hazardous Wastes - Identification for Toxic Substances Content. However, according to the National Hazardous Wastes (2021 Version), PFOS is the banned chemical substance among the restricted chemicals in the POPs Convention, belonging to other substances of hazardous wastes HW49 while the PFOS content in the chromium mist suppressant is over 95%, which falls into the category of hazardous wastes.

The above-mentioned two categories of PFOS wastes will be disposed of in accordance with China's requirements on hazardous wastes management. Therefore, the main environmental impacts of the project will be the environmental impact generated in the process of the storage (temporary), transportation and disposal of the hazardous wastes, including (1) The possible leakage in the process of collection, the leakage caused by incidents in the process of transportation, and the spillage and leakage in the process of temporary storage; and (2) Besides, the most critical risks are the environmental pollution such as waste gases, residues and noises in the process of hazardous incineration and disposal by the disposal units, as well as emergency accidents or the environmental, health and safety risks caused by the mismanagement of the occupational health and safety.

The above mentioned hazardous waste collection and disposal activities should follow strictly WBG EHS Guidelines on Hazardous Waste Management, as well as Chinese national and local laws and requirements, like Law of the People's Republic of China on the Prevention and Control of Solid Waste Pollution, etc.

### **3.4 Impacts of Force Majeure**

The implementation of the project will be affected by all kinds of force majeure, especially at this stage of COVID-19. The epidemic situation may affect the implementation progress of the project, but has no direct negative environmental impact on the activities under the project, but it may cause some health and safety problems, such as infection with covid-19.

Pertaining to the impacts of health and safety caused by force majeure in the original activities and the newly added activities of the project, the project implementation units and stakeholders shall take all reasonable measures to safeguard the health, safety and other legal rights according to the relevant requirements on occupational health and safety in the World Bank's General EHS Guidelines, WHO guidelines, the national and local laws, regulations and policies, as well as the specific management regulations and measured released by the national and local governments related to the COVID-19 (for detailed requirements in 4.2.5). The project will prefer those contractors (project implementation units) that are capable to manage the occupation health and safety of their employees, and ensure that the contractors

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will implement the hazard management rules through formal procurement agreements.

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## 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* and *OP4.09 Pest Control*. 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 grant-funded project activities; determination of project ESIA; scope for relevant requirements of environmental impact analysis, requirements of information disclosure and public participation, and the requirements to prepare and implement Environmental and Social Management Plans, shall all meet *OP4.01 Environmental Assessment* requirements.

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*.

World Bank Policy on Access to Information 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, Environment, Health and Safety Guidelines for Waste Management Facilities.

### 4.2 Applicable laws & regulations

This project is part of China's effort in implementing 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 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
Cleaner production	<i>Law of PRC on Promotion of Cleaner Production</i> (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 its production, we will take compulsory cleaner production auditing measures.
	<i>Interim Procedures for Clean Production Audit</i> (July 2016)	The law contains regulations, procedures and organizational management for mandatory cleaner production audit of enterprises applicable to PFOS production and emission.
	<i>Provisions on Cleaner Production Audit of Key Enterprises</i> (December 2005)	This law contains provisions of cleaner production auditing of key enterprises and main list of hazardous substances in auditing, and is applicable to PFOS production and emission.
Information disclosure and public participation	<i>Rules on Environmental Information Disclosure of Key Enterprises and Institutions</i> (effective since January 1, 2015)	This law contains information disclosure and public scrutiny of toxic and harmful chemical pollutants; applicable to PFOS.
	<i>Notice on Release of Government Information Guide on Construction Project's Environmental Impact Assessment</i> (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.
	<i>Rules on Public Participation in Environmental Protection</i> (MEP-Decree 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.
	<i>Guiding Opinions on Promoting Public Participation in Environmental Protection</i> (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.

Management category	Name of laws and regulations (Effective date)	Contents applicable
Occupational safety	<i>Production Safety Law of PRC</i> (November 2002)	This law contains risk prevention, spill prevention and emergency response applicable to the production, storage and transport of PFOS-containing chemicals.
	<i>Laws on Prevention and Cure of Occupational Diseases of PRC</i> (May 2002)	This law contains control measures on occupational safety and health risks applicable to using of PFOS-containing chemicals.
	<i>Regulations on Labor Protection in Workplaces Where Toxic Substances Are Used</i> (No.352 issued by the State Council, May 12th 2002)	This regulation includes 8 chapters with 71 articles. Including: General provisions, preventive measures in workplaces, Protection in working process, occupational health surveillance, workers' rights and obligations, supervision and administration, penalty provisions and supplementary provisions. The objective of this law is to ensure prevent, control and mitigate occupational toxic hazards by safe usage of toxic products in workplaces, for the protection of workers' life, healthy and rights. It follows the principle of classified management and clarifies special administrative methods for highly toxic operation.
Permit of pollution emission	<i>Notice of issuing the implementation scheme of pollution emission permit by the general office of the State Council</i> (No.81 document issued by the general office of the state council (2016)	The new system of "pollution emission permit", will adopt pollution permitting system as the core system of control the fixed pollution source for environmental management. The permit includes a variety of content including the species, concentration, quantity, direction and treatment facilities of pollutions, by way of "one permit" management. First, linking with the environmental assessment system on the time node and approval content of pollution emission, achieving the unified requirements for overall supervision; Second, integrate the control system of integrated quantity, realize the integrated management between pollution emission permit with the total quantity control of enterprises, upgrading the total quantity control of enterprises into legal responsibilities; Third, linking the actual emission data, linking with various systems such as pollution source monitoring, pollution discharge fee, environmental statistics, to solve the issue of multiple data from its root.
Environmental risk and emergency	<i>Method of sudden environmental emergency</i> (No.34 decree of the MEP)	To regulate the environmental emergency management and comb the environmental emergency management system, there is a high composite trend with superposition and highly non-convention. Comprehensive and systematic regulations are conducted on environmental emergency management, specifying the works of risk control, emergency preparation, and emergency treatment and after recovery of the accident. The main content of the report includes 8 chapters and 40 items, mainly covering the characteristics of 5 aspects as follows: 1) Regulate the emergency management works in a systematically way to handle environmental accidents from the perspective of overall process. 2) Establish the basic system of emergency management of sudden environmental accidents; 3) Highlight the responsibilities of main environmental bodies of enterprises and institutions; 4) Specify the sequence of priority safety of sudden environmental accidents; 5) Part of punishment rules is newly designed based on the limits of authority of departments.

#### 4.2.2 Regulations and laws on chemicals management

PFOS is the new kind of the POPs controlled chemicals in accordance with *the Stockholm Convention on Persistent Organic Pollutants*. *Regulations on the Control over Safety of Dangerous Chemicals* is the basic law for chemical management in China. In addition, there are a series of special departmental regulations on export & import of toxic chemicals and application and registration system of new chemicals, as summarized in Table 4-2.

**Table 4-2 Regulations and laws on hazardous chemicals**

Field	Name of laws and regulations (Effective date)	Contents applicable
Hazardous chemicals	<i>Regulations on the Control over Safety of Dangerous Chemicals</i> (State Council Decree No. 591, released and effected on December 7, 2013)	This law contains safety supervision and management rules of dangerous chemicals during its production, storage and use.
	<i>Measures for Implementation on Safety Permits of Enterprises in Production of Dangerous Chemicals</i> (MEE Decree NO.22, effected on March 1, 2013)	<p>1) Registration system is adopted for dangerous chemicals to regulate the key production enterprises using environmentally dangerous chemicals. The assessment of environmentally dangerous chemicals should be given with priority;</p> <p>2) Import environmental management registration system: In accordance with international convention of <i>Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade</i> and <i>Stockholm Convention on Persistent Organic Pollutants</i>, fulfill the obligations of prior informed consent procedure;</p> <p>3) Environmental management registration must be conducted for the key environmentally dangerous chemicals with the annual production of no less than 100 kg; The enterprises using key dangerous chemicals will submit registration tables and environmental risks assessment report when registration. The risks assessment report will include the assessment of environment exposure, risks and control measures of key environmental dangerous chemicals.</p> <p>4) The enterprises using or producing dangerous chemicals must release the annual report of dangerous chemicals management every January, informing the public of the species, hazardous characteristics, pollution emission, accidents and pollution control measures in the previous year. Additionally, the enterprise should also release the information of pollution emission and transfer and monitoring results of key environmentally dangerous chemicals.</p>
	<i>List of Hazardous Chemicals</i> (2015)	<p>PFOS is included in List of Hazardous Chemicals (2015)</p> <p>N - methyl-PFOS(31506-32-8)</p> <p>N- (2- hydroxyethyl) -N-methyl PFOS(24448-09-7)</p> <p>Potassium perfluorooctanesulfonate (1763-23-1)</p> <p>Perfluorooctane sulfonate (29081-56-9)</p> <p>Perfluorooctane sulfonic acid-ammonium sebacate (251099-16-8)</p> <p>Perfluorooctanesulfonate diethanol ammonium (70225-14-8)</p> <p>Perfluorooctane sulfonate potassium (2795-39-3)</p> <p>Lithium perfluorooctane sulfonate (29457-72-5)</p> <p>Heptadecafluorooctanesulfonic acid tetraethylammonium salt(56773-42-3)</p> <p>Perfluorooctanesulfonyl fluoride(307-35-7)</p>

		N-Ethyl-N-(2-hydroxyethyl) perfluorooctane sulfonamide (1691-99-2) N- Ethyl perfluorooctane sulfonamide (4151-50-2)
New chemicals	<i>Environmental Management and Register Measures on New Chemical Substances</i> (MEE, Order No. 12. Effected on January 1, 2021)	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. According to the production and sales volume, make the management regulations as routine registration, simple registration and record

#### 4.2.3 Technical guidelines for contaminated sites

In order to enhance environmental management during the process of land development, protect human health and ecological environment, content, work procedures and technical requirements of site survey will be standardized. Since 2008, the state Environmental Protection Ministry has initiated the preparation of guidelines for polluted site investigation, monitoring, evaluation and risk management. Based on the latest standards of soil quality and technical regulation, the MEP announced four guidelines including site survey, site environment monitoring standards, risk assessment of polluted site and polluted site rehabilitation in 2014.

- 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

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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.

#### **4.2.4 Guides and standards for identification and disposal of hazardous wastes**

In order to implement the *Environmental Protection Law Of The People's Republic Of China* and *The Law Of The People's Republic Of China On The Prevention And Control Of Environmental Pollution*, *Law of the People's Republic of China on the Prevention and Control of Solid Waste Pollution*, A series of guidelines and standards have been formulated to prevent and control environmental pollution caused by hazardous waste, strengthen the management of hazardous waste, protect environment and human health. The standard guidelines related to the project activities are as follows:

1) ***Identification For Hazardous Wastes, General Rules (GB5085-2019)***, which is an integral part of the national standards for the identification of hazardous wastes. The national standards for the identification of hazardous wastes stipulate the technical indicators of hazardous characteristics of solid wastes. Solid wastes with hazardous characteristics conforming to the technical indicators specified in the standards belong to hazardous wastes, and shall be managed according to law.

2) ***Identification For Hazardous Wastes, Identification For Toxic Substance Content (GB 5085.6)***. This standard specifies the identification standards for hazardous wastes containing toxic, carcinogenic, mutagenic and reproductive toxic substances, and is applicable to the identification of toxic substances in solid wastes produced in production, life and other activities of any industry.

3) ***Standard For Pollution Control On Hazardous Waste Storage GB18597-2001*** specifies the general requirements for the storage of hazardous waste, the requirements for the packaging of hazardous waste, the location of storage facilities, design, operation, safety protection, monitoring and closing, etc., and applicable to pollution control and supervision and management of all hazardous waste (except for tailore) storage, and applicable to the producers of hazardous wastes Operators and managers.

4) ***Standard For Pollution Control On Hazardous Waste Incineration GB18484-2020***, this standard, based on the needs of environmental pollution prevention and control during the process of hazardous waste treatment, specifies the site selection principle, basic technical performance index of incineration, the maximum allowable emission limit of atmospheric pollutants discharged by incineration, disposal principle of incineration residue and corresponding environmental monitoring. This standard is applicable to the design, environmental impact assessment, completion acceptance and pollution control management of hazardous waste incineration facilities except explosive and radioactive substance.

5) ***Technical Specification For Collection, Storage And Transportation Of Hazardous Wastes (HJ2025-2012)*** specifies the technical requirements to be followed in the process of collection, storage and transportation of hazardous wastes, and is applicable to the collection, storage and transportation activities of hazardous waste generating units and business units.

#### **4.2.5 Regulations and guidance of COVID-19**

1) ***Rational use of personal protective equipment (PPE) for coronavirus disease (COVID-19) (WHO Interim guidance)*** summarizes WHO's recommendations for the rational

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use of personal protective equipment (PPE) in health care and community settings, as well as during the handling of cargo; in this context, PPE includes gloves, medical masks, goggles or a face shield, and gowns, as well as for specific procedures, respirators and aprons. It is intended for those involved in distributing and managing PPE, as well as public health authorities and individuals in health care and community settings, and it provides information about when PPE use is most appropriate.

**2) Advice on the use of masks in the context of COVID-19 (WHO Interim guidance)** provides advice on the use of masks in communities, during home care, and in health care settings in areas that have reported cases of COVID-19. It is intended for individuals in the community, public health and infection prevention and control (IPC) professionals, health care managers, health care workers (HCWs), and community health workers. It will be revised as more data become available.

**3) Water, sanitation, hygiene, and waste management for the COVID-19 virus (WHO Interim guidance)** supplements the infection prevention and control (IPC) documents by summarizing WHO guidance on water, sanitation and health care waste relevant to viruses, including coronaviruses. It is intended for water and sanitation practitioners and providers and health care providers who want to know more about water, sanitation and hygiene (WASH) risks and practices.

**4) ESF/SAFEGUARDS INTERIM NOTE: Covid-19 Considerations In Construction/Civil Works Projects** is intended to provide guidance to teams on how to support Borrowers in addressing key issues associated with COVID-19, and consolidates the advice that has already been provided over the past month. As such, it should be used in place of other guidance that has been provided to date. This note will be developed as the global situation and the Bank's learning (and that of others) develops. This is not a time when 'one size fits all'. More than ever, teams will need to work with Borrowers and projects to understand the activities being carried out and the risks that these activities may entail. Support will be needed in designing mitigation measures that are implementable in the context of the project. These measures will need to take into account capacity of the Government agencies, availability of supplies and the practical challenges of operations on-the-ground, including stakeholder engagement, supervision and monitoring. In many circumstances, communication itself may be challenging, where face-to-face meetings are restricted or prohibited, and where IT solutions are limited or unreliable.

**5) Regulations on public health emergencies (Decree No. 376 of the State Council)** is formulated to prevent, control and eliminate the harm of public health emergencies effectively, to ensure the public health and life safety, and to maintain normal social order.

**6) Law of the People's Republic of China on the Prevention and Treatment of Infectious Diseases (Chairman's order)** This law is formulated for the purpose of preventing, controlling and eliminating the occurrence and prevalence of infectious diseases and ensuring human health and public health. The State adopts the policy of putting prevention first in the prevention and control of infectious diseases, which combines prevention and control, classifies management, relies on science and the masses.

**7) New COVID-19 prevention and control program (released in May, 2021)** is formulated to guide the local government to carry out the normal prevention and control of the epidemic situation. It insist in the principle of "prevention first, combination of prevention and control, scientific and classified according to law", firmly preventing the import of overseas epidemic and rebound of domestic epidemic in accordance with the work requirements of "timely detection, rapid disposal, precise control and effective treatment".

**8) Notice on novel COVID-19 prevention and control work in accordance with the law**

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**and scientific accuracy (Joint prevention and control mechanism [2020] No.28)**

According to the development trend of the current epidemic prevention and control situation, this notice highlights the key points, makes overall plans, gives classified guidance, implements policies in different areas, adheres to the prevention and control in accordance with the law, scientific prevention and control, and focuses on various measures to improve the scientificity, accuracy and pertinence of epidemic prevention and control.

**4.2.6 Other relevant technical guides and standards**

Other relevant technical guidelines applicable in the electroplating, firefighting industry, and the PFOS production are mainly as follows. (Those relevant to pesticides are shown under the Pest Management Plan in Annex 4.)

**(I) Standards of Electroplating Industry (No.64 of 2015, Ministry of Industry and Information Technology)**, main requirements include:

- 1) The enterprise will apply cleaner production processing of low pollution, emission, energy consumption, water consumption, economic and efficient.
- 2) The electroplating enterprises of single variety and continuous production will require the automatic production line and semi-automatic line will be more than 70%.
- 3) The ground of production area will be taken with anti-corrosion, anti-seepage measures. Also there are devices of collecting plating fluid and cleanout fluid in the production line.
- 4) There are multiple water-saving fixture in the production line of newly-built or expansion project. Also they have liquid recycling devices. The pipelines are installed in accordance with the principle of "visual and controllable". The preventative measures of corrosion prevention and damage prevention are also prepared.
- 5) Considering the type and quantity of the machinery parts, the continuous processing equipment with high efficiency and low consumption will be adopted, reaching the level higher than Class II as specified in the requirements of cleaner production in electroplating industry.

**(II) Discharge Standards of Electroplating Pollution (GB21900-2008)**

This applies since there is no discharge standards specially for PFOS.

**(III) Discharge Standards of Wastewater (GB8978-1996)**

This applies since there is no wastewater standards specially for PFOS production.

**(IV) Discharge Standards of Air pollutants (GB16297-1996)**

This applies since there is no air emission standards specially for PFOS production.

**4.2.7 Relevant announcement**

- 1) Announcement on the Effectiveness of the Amendment to Annex A, Annex B and Annex C of the Nine Newly Added Persistent Organic Pollutants and the Amendment to Annex A of Newly Added Endosulfan of the Stockholm Convention on Persistent Pollutants (by multiple ministries and commissions)

From March 26, 2014, the production, circulation, use, import and export of lindane, perfluorooctyl sulfonic acid and its salts, perfluorooctyl sulfonyl fluoride, endosulfan are prohibited except for the specific exempted and acceptable purposes (see the attached table). Concerning the specific exempted purposes, substitutes should be developed as soon as possible to ensure the entire elimination before the expiration of the exemption; and concerning the acceptable purposes, efforts should be made to enhance the management and

risk prevention and strive to gradually eliminate their production and uses.

2) Announcement on Prohibiting Production, Circulation, Use, Import and Export of Persistent Organic Pollutants of Lindane and Others (Announcement 2019 NO. 10) (by multiple ministries and commissions)

From March 26, 2019, the production, circulation, use, import and export of perfluorooctyl sulfonic acid and its salts and perfluorooctyl sulfonyl fluoride are prohibited except for acceptable uses.

3) Announcement of Ministry of Agriculture and Rural Affairs of the People’s Republic of China NO.148 (Sulfluramid)

Since the date of this announcement, the pesticide registration and registration renewal of sulfluramid-containing pesticide products (including the active ingredient’s original compound, single agent, and compound formulation, the same below) will no longer be accepted and approved.

From March 26, 2019, the pesticide registration and production permit of sulfluramid-containing pesticide will be cancelled.

From January 1, 2020, it is prohibited to use the sulfluramid-containing pesticide products.

### 4.3 Gap analysis

There is some research already about the comparison of China’s environmental and Social impact assessment system with that of the WB<sup>1</sup>. This report only provides the laws and standards of China which are the most relevant, directly related and have no comparison analysis, to compare with the standards of WB.

The comparison of laws and regulations in China and abroad related to pesticides, is shown in Chapter II of the Pest Management Plan in Annex 4.

The proposed project has triggered environmental guidelines of the World Bank, mainly EHS guidelines for Semi-conductors and Other Electronic Products. As it covers the management requirements of PFOS in electroplating industry and emission standards of wastewater and exhaust of fluoride. The related national discharge standards and EHS guideline of WB are compared and analyzed as follows.

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

China	World Bank
<p><b><i>Cleaner Production Standards for Electroplating Industry (HJ/T314-2006)</i></b></p> <p><b>Requirements of environmental management:</b></p> <p>1、 <b><i>Laws and Regulations on Environmental Protection:</i></b> conform to local and national laws and regulations. The pollutant emission is in compliance with local and national standards, and management requirements of the total quantity control and pollution emission permit.</p> <p>2、 <b><i>Environmental review:</i></b> In accordance with <i>Requirements and Guidelines of Environmental Management System (GB/T 24001)</i>, establish and operate the environmental</p>	<p><b><i>EHS Guideline for Semiconductor and Other Electronic Products Manufacturing Industry</i></b></p> <p>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</p>

<sup>1</sup> Implementation of Environ Impact Assessment in China, *Journal of Environ Assessment Policy and Management* (Single author, Eng.), Imperial College Press, No.3, V15, 2013; and Research of comparative analysis on World Bank and China’s EIA, *Journal of Environment Protection*, No5, 2010, P76-78.

China	World Bank
<p>management system, prepare project management manual, and procedural document and operation documents.</p> <p>3、 Waste disposal: With complete and efficient treatment facilities for wastewater and exhaust gas, we will use proper electroplating waste collection device and legal treatment channel. At the production site, install reliable air suction device to treat hazardous gas. The sludge during wastewater treatment process will be identified in accordance with <i>Identification Standards for Hazardous Wastes</i>. The hazardous wastes will be disposed according to the standards with qualified disposal facilities. The treatment rate will reach up to 100%. Forbidden to mix them with domestic solid waste.</p> <p>4、 <b>Environmental management during production process:</b> Keep the environment clean and in good order at the production site. The hazardous products will be marked.</p> <p>5、 <b>Environmental management of relevant parties:</b> Procure products from qualified supplier of raw materials. Exert influences on the product quality, packaging transportation and other procedures; Transfer hazardous wastes to qualified enterprises for treatment.</p>	<p>controlled disposal of wastes if no alternatives product is available, for example, the short-wave technology;</p> <p>2. Emission standard of hydrogen fluoride gas (at standard state): 5mg/m<sup>3</sup>;</p> <p>3. Discharge standard of fluoride-contained effluent: 5mg/L.</p>
<p><b>Emission Standard of Pollutants for Electroplating (GB21900-2008)</b> Wastewater effluent from existing and new enterprises:</p> <p>1、 SS: 50 mg/L (Same as EHS) 2、 COD: 80 mg/L (Lower than EHS) 3、 Hydrogen Fluoride: 15 mg/L (Higher than EHS) 4、 fluoride-contained effluent: 10 mg/L (Higher than EHS) 5、 Total Chrome: 1.0 mg/L (Higher than EHS) 6、 Cr (VI): 0.2 mg/L (Higher than EHS) 7、 Other Metals: Cd: 0.05 mg/L (Lower than EHS) Cu: 0.5 mg/L (Same as EHS) Pb: 0.2 mg/L (Higher than EHS) Hg: 0.01 mg/L (Same as EHS) Ni: 0.5 mg/L (Same as EHS) Ag: 0.3mg/L (Higher than EHS) Zn: 1.5 mg/L (Lower than EHS) Al: 3.0 mg/L (EHS No requirement )</p>	<p><b>EHS Guideline for Semiconductor and Other Electronic Products Manufacturing Industry</b></p> <p>1、 SS: 50 mg/L 2、 COD: 160 mg/L 3、 BOD: 50 mg/L 4、 Hydrogen Fluoride: 10 mg/L 5、 fluoride-effluent: 5mg/L 6、 Total Chrome: 0.5 mg/L 7、 Cr (VI): 0.1 mg/L 8、 Other Metals: Cd: 0.1 mg/L Cu:0.5 mg/L Pb:0.1 mg/L Hg:0.01 mg/L Ni:0.5 mg/L Sn: 2 mg/L Ag:0.1 mg/L As:1 mg/L Zn:2 mg/L</p>
<p><b>Air pollutants limits in the National Metal Plating Pollutant Discharge Standards:</b></p> <p>HCl: 30 mg/m<sup>3</sup> (Higher than EHS) NOx: 200 mg/m<sup>3</sup> (Not covered in EHS) HCN: 0.5 mg/m<sup>3</sup> (Not covered in EHS) Chrome mist: 0.05 mg/m<sup>3</sup> (Not covered in EHS) Sulfate mist: 30 mg/m<sup>3</sup> (Not covered in EHS) F-: 7mg/L (Slightly higher than EHS)</p> <p><b>Integrated Discharge Standards for Air Pollutants (GB16297-1996)</b> F-: 20μg/m<sup>3</sup>, or 0.02mg/m<sup>3</sup></p>	<p><b>EHS of Semi-conductors and other Electrical Products</b></p> <p>HF (standard condition): 5mg/m<sup>3</sup> HCl: 10 mg/m<sup>3</sup> HF: 5 mg/m<sup>3</sup> PH<sub>3</sub>: 0.5 mg/m<sup>3</sup> NH<sub>3</sub>: 30 mg/m<sup>3</sup></p>
<p><b>Integrated Wastewater Discharge Standard (GB8978-2012)</b></p>	<p><b>EHS Guideline</b></p>

China	World Bank
Discharge standard of fluoride-contained wastewater: Yellow phosphorus industry: 10mg/L (grade-I), 20mg/L (grade-II), 20mg/L (grade-III); Low fluorine-content areas (<0.5 mg/L): 10 mg/L (grade-I), 20 mg/L (grade-II), 30 mg/L (grade-III)	Discharge standard of fluoride-contained effluent: 5mg/L.
<p><b>Standard For Pollution Control On Hazardous Waste Incineration</b> GB18484-2020. Emission indicators of flue gas pollutants from incineration facilities are:</p> <p>Particulate matter 20 mg / m<sup>3</sup> (higher than EHS, according to EU standard)</p> <p>Carbon monoxide 80 mg / m<sup>3</sup> (consistent with EHS)</p> <p>Nitrogen oxide 250 mg / m<sup>3</sup> (no such index for EHS)</p> <p>Sulfur dioxide 80 mg / m<sup>3</sup> (no such index for EHS)</p> <p>Hydrogen fluoride 20 mg / m<sup>3</sup> (no such index for EHS)</p> <p>Hydrogen chloride 50 mg / m<sup>3</sup> (higher than EHS, according to EU standard)            (the above are 24-hour average values)</p> <p>Mercury and its compounds 0.05 mg/m<sup>3</sup></p> <p>Thallium and its compounds 0.05 mg/m<sup>3</sup></p> <p>Cadmium and its compounds 0.05 mg/m<sup>3</sup></p> <p>Lead and its compounds 0.5 mg/m<sup>3</sup></p> <p>Arsenic and its compounds 0.5 mg/m<sup>3</sup></p> <p>Chromium and its compounds 0.5 mg/m<sup>3</sup>            (the above metal indicators are lower than EHS, calculated according to EU standards)</p> <p>Tin, antimony, copper, manganese, nickel, cobalt and their compounds 2.0 mg / m<sup>3</sup> (no such index for EHS)\</p> <p>Dioxins (ng TEQ / Nm<sup>3</sup>) 0.5 (higher than EHS, according to American Standard)</p>	<p><b>EHS guidelines, waste management facilities</b> refer to the air emission standards of hazardous waste incineration plants in EU and USA</p> <p>EU:</p> <p>Particulate matter 10 mg / m<sup>3</sup> (24-hour average)</p> <p>Carbon monoxide or hydrocarbons 50-150 mg / m<sup>3</sup></p> <p>Total chlorine content (HCl, Cl<sub>2</sub>) 10 mg / m<sup>3</sup></p> <p>Mercury 0.05-0.1 mg / m<sup>3</sup> (0.5-8 hour mean)</p> <p>Semi volatile metals (lead, cadmium) 0.5-1 mg / m<sup>3</sup> (0.5-8 hours average)</p> <p>Low volatile metals (as, be, Cr) 0.5-1 mg / m<sup>3</sup></p> <p>U.S.A:</p> <p>Particulate matter 1.5 mg / dscm</p> <p>Carbon monoxide or hydrocarbon 100 (CO) ppmv 10 (HC) ppmv</p> <p>Total chlorine content (HCl, Cl<sub>2</sub>) 21ppmv</p> <p>Mercury 8.1 ug / dscm</p> <p>Semi volatile metals (lead, cadmium) 10 ug / dscm</p> <p>Low volatile metals (as, be, Cr) 238.1 ug / dscm</p> <p>Dioxins and furans (based on TED) 0.2</p> <p>Destruction and removal efficiency 99.99% - 99.9999%</p>

For water pollutant discharges, the Discharge Standards of Electroplating Industry and the Class I of the Integrated Wastewater Discharge Standards in China is applicable to the project. The non-metallic indicators are slightly less strict than those in the EHS of Semi-conductors and other Electrical Products. For some indicators the difference is significant, for example the domestic standard for F- in wastewater is 10 mg/L, higher than that in the EHS standard (5 mg/L). For metallic indicators, those standards are similar to the EHS ones. As for the discharge of gas pollutants, the domestic standard for metal plating wastewater discharging are less strict than those in the EHS standards for all comparable indicators.

However, the Bank's guidelines and standards are applicable to all kinds of electronic products, not just plating. Electroplating commonly used in electronic products, such as integrated circuit boards, is not the same as electroplating larger industrial parts under this project. Therefore, the WB's EHS emission standards may not be directly applicable. For the metal related parameters, the domestic standards are similar to the WB's. Complying with

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domestic standards will ensure compliance with WB requirements to control the environmental impact effectively.

Compared with the European Union and the United States, China's emission standards for waste disposal are basically at the same level, and some of them are slightly different. In terms of particulate matter emission, it is lower than EU and US standards, but in terms of other pollutants, it is equal or higher than EU and US standards, including hydrocarbons and some heavy metals.

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## Chapter 5. Environmental screening and management requirements

This chapter summarizes the procedure and criteria for FECO and Provincial PMOs (PPMOs) to screen and select sub-projects and to manage their potential impacts during implementation. It also serves as guidance for subprojects on conditions and preparation they need in order to participate.

### 5.1 Subproject selection criteria

The National PMO, FECO, and provincial PMOs should select the subprojects against relevant environmental criteria. From the environmental perspective, all PFOS production enterprises should be covered (though more screening criteria needed from other perspective), therefore the criteria below do not apply to PFOS production enterprises.

- **Criteria 1:** The subproject shall belong to the priority sectors. Their processes are typical with PFOS produced or used.
- **Criteria 2:** The enterprise should have sufficient environmental approval and permits for its operation.
- **Criteria 3:** The enterprise is generally compliant with discharge standards with no major violation or environmental incident.

### 5.2 Environmental preparation of subprojects

The subprojects can be either enterprises or non-enterprise entities. For the enterprises, there are scenarios in subprojects, including (1) conversion to other products, (2) retrofit or technical renovation; (3) alternative application; and (4) plant closure. Non-enterprise entities are for pesticide and firefighting applications. Based on national regulations and WB safeguard requirements, subproject entities will need to conduct the below safeguard work respectively:

#### 5.2.1 Enterprise to convert to other products

For the participating enterprise that will convert to the production of other non-PFOS products, an environmental impact assessment (ESIA) is likely needed as per domestic regulation and the WB safeguard policies. The ESIA prepared should be submitted to local environmental protection bureaus (EPB) for approval and to the WB for review too. Based on the ESIA, Environmental and Social Management Plan (ESMP) needs to be developed as part of the ESIA to propose mitigation measures and action plans. Terms of Reference (ToR) and requirements on ESIA/ ESMP are in Annex 1. The ToR specifies that baseline investigation in the ESIA is in effect environmental audit of current situation and should meet the requirements of an Environmental Audit detailed in Annex 2.

When an ESIA is needed per domestic regulations, the enterprise should be responsible for preparation and to seek approval of such ESIA. The key sections and measures should be integrated into the EMP.

#### 5.2.2 Enterprise to retrofit

Participating enterprise undergoing technical retrofit are mainly in the metal plating sector (i.e., adopting closed-loop metal plating process, or retrofitting treatment facilities for the metal plating wastewater). Domestically ESIA might not be necessary as the retrofit will

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reduce the environmental risks by reducing discharge and improving wastewater treatment facilities. However, simplified ESIA is required by the WB, with focus on the ESMP in order to mitigate adverse impacts of retrofit. Detailed requirements on ESIA/ ESMP also refer to Annex 1 but can be prepared in simplified manner. The ToR for ESIA specifies that baseline investigation is in effect an environmental audit of current situation and should meet requirements of an Environmental Audit.

### **5.2.3 Enterprise to close down**

For enterprise that will close down its plant or production lines (mainly for PFOS production) under the project, environmental site assessment should be conducted based on relevant domestic and WB requirements. If necessary, supplementary environmental monitoring should also be conducted to analyze the site pollution conditions and long term impacts. The environmental site assessment report should include an EMP to address impacts during dismantling and urgent preliminary cleanup if needed. For detailed requirements and ToR of environmental site assessment see Annex 3.

This Project will only support the site assessment and demolishing of equipment and pipelines after the facilities are closed. However, if the future use of the land can be determined during the project implementation, the ESMP can also propose relevant site remediation and restoration measures which is also termed as site restoration plan.

### **5.2.4 Non-enterprise subprojects**

The non-enterprise subprojects are mostly in the sectors of pesticide and firefighting application.

- (1) Agriculture use: The subprojects promoting substitutes for PFOS-containing pesticides have publicly disclosed this ESMF and the Pest Management Plan (PMP, see a summary in Annex 4). They will participate in the trainings organized by different levels of PMOs. The implementing units should provide written commitment to ensure that the PMP should be implemented accordingly, and to clearly define the institutional arrangements and their responsibilities.
- (2) Firefighting: the PFOS containing firefighting foam is mainly used by firefighting department. When the firefighting testing and demonstration units (such as training bases) are selected, ESIA needs to be conducted following domestic regulations and WB policies as there might be environmental impacts. While the ESIA can be simplified, the focus will be the development of the ESMP (see also Annex 1).
- (3) Waste disposal: this activity is mainly related to waste producing units (i.e. foam production enterprises, production and use of CMS) and hazardous waste collection and recovery units, including waste disposal technology assessment units (TA activities).

To mitigate the environmental and social risks related to the new activity of PFOS containing waste collection and disposal, the hazardous waste disposal vendors will be selected by FECO by adopting the eligibility criteria: (1) hazardous waste operation permit for the relevant disposal facilities; (2) ESIA for the hazardous disposal facilities and approved by authorities; (3) pollutant discharge permits for the relevant disposal facilities; (4) generally compliant with discharge standards with no major violation or environmental and social incidents; (5) land certificate. And an audit to cover both environmental and social risks in connection with the proposed waste disposal facilities will be conducted by external consultant hired by client before the vendor is

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selected and contracted by FECO. The typical social risks would include labor and working conditions (particularly OHS risks), community health and safety, among others. The requirement of the updated ESMF will be followed for the hazardous disposal vendor screening to address E&S risks. The requirements of the existing ESIA and the auditing findings will be integrated into the future ESMP for the PFOS containing waste collection and disposal activities. The ESMP can be prepared to determine the mitigation measures, so as to guide the implementation of the activities and reduce the possible negative environmental impact during the activities.

- (4) In terms of PFOS waste disposal technology assessment, FECO will select the contractor with test ability and disposal ability and complete qualification such as ESIA to carry out. As this activity is a consulting service and is of trial (the total test consumption is not more than 10kg), which has limited impact on the environment. Therefore, FECO will require the contractor to have a good behavior in risk control and pollutant disposal in the process of hazardous waste storage and disposal, and make specific requirements for its environmental management in the TOR, proposal preparation and contract stage, to minimize the impact on the environment. In addition to the above demonstration projects, all TA activities in the new activities will include the environmental and social safeguards factors into the project activity design, and evaluate the impact of the research content on the environmental and social safeguards. If there is any impact, put forward/prepare mitigation measures, and promote the capacity-building of relevant institutions when possible.

### **5.3 Information disclosure and public participation**

As the project is categorized Class A, the environmental documents will be required to be publically disclosed and consulted for at least two rounds to solicit public opinions. In order to meet the domestic regulations and WB standards, each information disclosure and public participation will need to meet the following requirements.

(1) Enterprises or agencies 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. PMOs 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.

(2) Demonstration enterprises or agencies 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 (i.e., 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 ESIA 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 FECO and Provincial PMOs in accordance with the requirements of WB.

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

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- 2) ESIA report form for domestic approval/ ESIA report and the copy of the approval;
  - 3) Review-related additional materials considered as necessary by the national PMO (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 the first subproject of each industry and all Category A demonstration project (equivalent to the domestic project in need of full ESIA). 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 arrangement**

Contents in foregoing environmental documents prepared (especially the ESMP), 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, MEE is responsible for the overall coordination of China in POPs compliance. Through its FECO, MEE is responsible for leading the implementation of this project. According to project characteristics, its environmental protection measures fall under the regulation of provincial ecology and environment department (bureau), but also the supervision of WB. The main responsibilities of relevant environmental administrative organizations are as follows:

With the help of environmental experts and local EEB, FECO will be responsible for the supervision of project component's ESMP implementation, and be responsible to regularly report to the WB on the implementation of ESMP. As the national PMO, FECO is the contact agency for the World Bank. The FECO is in charge of the coordination and project management. The Provincial PMOs are in charge of the supervision of the implementation of mitigation measures in their Provinces. The local EEBs are responsible for ensuring the activities 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 PPMO. Second, FECO directly carries out activities in corresponding demonstration enterprises or executive units. Whatever the implementation approach is, the subject of ESMP shall be enterprises (including pesticides and fire protection units). Enterprises or executive units are obliged to accept checks and supervisions of PMOs at all levels at any time, and to submit to them with data and documents as required by EMP. Sub-project agreements and contracts signed by the PMOs shall clarify above responsibilities and obligations.

PMOs at all levels shall supervise the implementation of ESMP by demonstration enterprises to check whether they meet the relevant requirements of administrative department in charge of environmental protection and WB Safeguard Policies. In addition, during the project implementation period, FECO shall regularly inspect the project site of demonstration enterprises at least once a year. If FECO finds that enterprises fail to properly carry out ESMF, it will increase its frequency of on-site supervision, until the situation is improved.

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

## **5.6 Reporting and requirements**

In order to carry out high quality environmental management, each PMO shall document their job in a timely manner and make summary. Each PMO shall submit a semi-annual progress report to FECO. The report shall include:

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- 1) Implementation of ESMP in project component during the reporting period.
  - 2) Implementation of PMP (if relevant);
  - 3) Review results and comments to documents submitted by demonstration enterprises;
  - 4) Environmental training undertaken during the reporting period;
  - 5) Quantitative environmental 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.

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

PMO at all levels may invite consulting units to carry out independent external monitoring for the implementation of ESMP.

Up to the project restructuring, the PMOs reported according to the above requirements. In particular, the progress of environmental and social security is described in detail in the project progress report. And for enterprises demonstration, all the information collected is confirmed and verified by a third-party management agency.

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## Chapter 6. Institutional capacity evaluation/building

### 6.1 Institutional capacity evaluation

#### 6.1.1 NPMO

The FECO, directly under the MEE, 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 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 and transactional requirements.

As the NPMO, FECO is familiar with management requirements for GEF-funded projects, 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 implemented the Safeguard Policies on projects granted by international financial institutions.

#### 6.1.2 PPMOs

According to requirement of project activities, 2 provincial-level PMOs have been established, at Hubei and Guangdong provincial environmental protection bureaus for the manufacturing industry and electroplating industry. The provincial PMO in Hubei is housed 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 EEB. 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 heavy metals pollution.
- 2) Undertaking awareness raising and education work and international cooperation work related to solid waste control and chemical pollution prevention.
- 3) Undertaking technical review on dismantled electronic waste 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 these requirements, Hubei Provincial Solid Waste Treatment Center has brought in PhDs in relevant fields to strengthen 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:

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- 1) To develop environmental protection publicity and education plan, formulate environmental protection regulations and manage the implementation of the same.
  - 2) To manage training 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 serious 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 projects in many 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 were actively involved 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.

PMOs at all levels, FECO and provincial PMOs have designated at least one person to manage the project's environmental social risks and ensure the implementation of EMP. Their CVs have been reviewed by WB team and considered as qualified for the project. The national and provincial PMOs of the project have existing environmental departments and they are very familiar with the laws, regulations and standards of project management. Meanwhile, their awareness of environmental safeguard policy is also very strong, ensuring that project environmental and social risks will be managed in accordance with the ESMF and that the EMPs will be implemented. In addition, the above-mentioned project management agencies are planning to invite qualified environmental consultants or agencies to assist the PMOs to support them in carrying out activities under this environmental and social management framework, and evaluate and manage the environmental risks during the assessment and implementation of the project.

During the project implementation, PMOs shall invite qualified environmental consultants and/or institutions to provide relevant environmental/social training to subproject/enterprises/project executive units which shall prepare and implement ESMPs 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.

After the implementation of the project, (1) all project offices participated in the training of

procurement and finance organized by the world bank and technical seminars sponsored by FECO. (2) In terms of project team building, the three project offices employ project assistants to assist in project implementation and carry out project activities. (3) In the aspect of activities, environmental and social factors are considered in TA activities. In the aspect of demonstration activities, third-party personnel are specially responsible for verifying, training and guiding the environmental and social security work of the project implementation unit, so as to ensure the implementation of the environmental and social security work of the world bank in accordance with this ESMF. Here are the activities implemented to enhance capacity.

activities	contents	Participants	remarks
Training	PFOS control policies and bank's management instruments (2017.11.10)	Bank, FECO, PPMOs, and all stakeholders	With at least 130 participants
	PFOS control policy updated in China (2020.11.11)	FECO, PPMOs, demonstration sites, consultants, etc.	With at least 50 participants
	Bank's environmental and social safeguard requirements	Demonstration sites/enterprises; third-party management agency; FECO; PPMOs	At least 5 times small scale trainings to different managers of demonstration enterprises and sites organized by FECO, PPMOs
Staff enhanced	FECO hired 2 assistants and more than 4 experts, and other CQs consultants	/	/
	Hubei PMO hired third-party management agency (providing one assistant) and other CQs consultants	/	/
	Guangdong PMO hired 3 assistants and other CQs consultants	/	/
TAs and demonstration activities	TOR of TAs include environmental and social safeguards considerations	/	/
	Youshida closure demonstrations	Provide trainings, prepare ESMP, etc. Implement ESMP/ESMF	/
	Henxgin Closure demonstrations	Provide trainings, prepare ESMP, etc. Implement ESMP/ESMF	/
	Other on-going demonstration activities	Provide trainings, prepare ESMP, etc. Implement	/

	ESMP/ESMF	
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## Chapter 7. Information disclosure and public participation

### 7.1 Information disclosure

#### 7.1.1 Disclosure of original ESMF

As a category-A project, the first draft of the policy framework has been publicized on the website of NPMO on March 23, 2016, in accordance with requirements of OP4.01 and relevant national policies (Website:

[Http://www.meefeco.org.cn/dtxx/tzgg/201603/t20160324\\_24929.html](http://www.meefeco.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. 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 and Social Management Framework* has been disclosed to the following organizations in the fields of manufacturing and application from June to August, 2016:

- (1) National Project Management Office, from June 27<sup>th</sup>, 2016 to July 11<sup>th</sup>, 2016, on the website of National Project Management Office ([http://www.meefeco.org.cn/dtxx/tzgg/201606/t20160627\\_67864.html](http://www.meefeco.org.cn/dtxx/tzgg/201606/t20160627_67864.html)).
- (2) Provincial Project Management Office, from July 4<sup>th</sup>, 2016 to July 18<sup>th</sup>, 2016, on the website of Hubei Provincial Department of Environmental Protection ([http://report.hbeeb.gov.cn:8080/pub/root8/tjgzs/gtfwgl/201607/t20160704\\_96104.html](http://report.hbeeb.gov.cn:8080/pub/root8/tjgzs/gtfwgl/201607/t20160704_96104.html)), Figure 7-1.
- (3) Meanwhile, on July 1<sup>st</sup>, 2016, it was also disclosed on the website of Hubei Academy of Environmental Sciences. (<http://www.hbaes.com/newsView.do;jsessionid=4E51050C2E10EE8AC1D43B5EC7E86063?infol=2010>), Figure 7-2.
- (4) Manufacturing Industry: from August 4<sup>th</sup>, 2016 to August 18<sup>th</sup>, 2016, on the website of the Yingcheng Environmental Protection Bureau (<http://www.hbyceeb.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.hbyceeb.gov.cn/html/2016/0803/891.html>).
- (5) Pesticide Application Industry: from June 27<sup>th</sup>, 2016 to July 11<sup>th</sup>, 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:
  - a) The NATESC: ([http://www.mt0033.com\\_www.natesc.gov.cn/Html/2016\\_07\\_01/2\\_1878\\_2016\\_07\\_01\\_429710.html](http://www.mt0033.com_www.natesc.gov.cn/Html/2016_07_01/2_1878_2016_07_01_429710.html))
  - b) Fujian Plant Protection Station (Fujian Agricultural Information Network, <http://www.fjagri.gov.cn/html/hypd/zwbh/zwjy/2016/07/04/161347.html>)
  - c) Guangdong Plant Protection Station (Guangdong Agricultural Information Network,

[http://www.gdagri.gov.cn/ywzx/zbzjzz/201607/t20160704\\_553553.html](http://www.gdagri.gov.cn/ywzx/zbzjzz/201607/t20160704_553553.html) )

- d) Guangxi Plant Protection Station (Guangxi Plant Protection Network, <http://www.gxzb.com/html/2016-07/2016201607011700248944.html> )
- e) Hainan Plant Protection Network (<http://www.hizb.cn/a/zhibaogonggao/2016/0711/64.html>)
- f) Yunnan Plant Protection Station (<http://www.ynzbzi.com/Item/163.aspx>).
- (6) 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>).

### 7.1.2 Disclosure of environmental and social safeguards documents during project implementation

- 1) Disclosure of environmental and social management plan of Hubei Youshida Technology Co., Ltd (closure demonstration)

Youshida disclosed its environmental and social management plan in September and November 2020 and April 2021 respectively on the company's website and on the bulletin board of the plant area. Public website: [http://www.yzdchem.com/news\\_detail/id/11.html](http://www.yzdchem.com/news_detail/id/11.html).

- 2) Disclosure of environmental and social management plan of Hubei Hengxin Chemical Co., Ltd (closure demonstration)

Hengxin made two rounds of disclosure of its environmental and social management plan on the company's website and the public notice board of the plant area in January and may 2021 respectively. Public website: [http://www.fluoride-cn.com/news\\_detail/typeid/1/id/23.html](http://www.fluoride-cn.com/news_detail/typeid/1/id/23.html).

### 7.1.3 Disclosure of updated ESMF after restructuring

This ESMF will be disclosed for the first time on June 2, 2021 on FECO website from June 2, 2021 to June 8, 2021. The website is: [http://www.fecomee.org.cn/dtxx/tzgg/202106/t20210602\\_835965.html](http://www.fecomee.org.cn/dtxx/tzgg/202106/t20210602_835965.html)

## 7.2 Public participation

### 7.2.1 Public participation of original ESMF

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 ill-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
<b>First draft of Policy Framework: The first round of public participation</b>		
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),	<ul style="list-style-type: none"> <li>Compliance requirements on PFOS in China (related policies &amp; notices)</li> <li>Arrangement of related activities.</li> <li>The WB's environmental &amp; social</li> </ul>

Date	Participants	Contents in discussion
	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)	safeguard policies and relevant requirements
2016.1.14	Discussion meetings/telephone interviews, FECO, industry experts, primary-level representatives from manufacturing enterprises	<ul style="list-style-type: none"> <li>• Analysis on national policy</li> <li>• Arrangement of related activities (manufacturing industry) and project progress</li> <li>• The WB's environmental &amp; social safeguard policies</li> </ul>
2016.3.14	Discussion meetings/telephone interviews, FECO, industry experts, and representatives from trade associations, electroplating enterprises and industrial park of electroplating	<ul style="list-style-type: none"> <li>• Analysis on national policy</li> <li>• Arrangement of related activities (electroplating industry) and project progress</li> <li>• The WB's environmental &amp; social safeguard policies</li> </ul>
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)	<ul style="list-style-type: none"> <li>• Arrangement of related activities and project progress</li> <li>• The WB's safeguard policies</li> </ul>
<b>Revised Policy Framework: The second round of public participation</b>		
2016.7.7	Discussion meetings/telephone interviews, representatives from the Chemours Company and FECO.	<ul style="list-style-type: none"> <li>•Activities of fire protection sector;</li> <li>•Demonstration enterprises within the fire protection sector</li> </ul>
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.	<ul style="list-style-type: none"> <li>•Requirements of national policy</li> <li>•Activities and budgets of electroplating industry</li> <li>•• The WB's safeguard policies</li> </ul>
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.	<ul style="list-style-type: none"> <li>•No comments were made by any enterprise.</li> </ul>
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.	<ul style="list-style-type: none"> <li>•No comments were made by any enterprise.</li> </ul>
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.	<ul style="list-style-type: none"> <li>•Parks and enterprises did not express any comments.</li> </ul>
July, 2016	Written consultation/ telephone interviews. After the second round of public announcement	<ul style="list-style-type: none"> <li>•Supports for procedures and requirements specified by the Policy</li> </ul>

Date	Participants	Contents in discussion
	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.	Framework of this project have been made.
<b>Environmental Audit Report: Hubei Hengxin</b>		
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.

**关于全球环境基金中国PFOS优先行业削减与淘汰项目环境管理框架的公示**

根据全球环境基金“中国PFOS优先行业削减与淘汰项目”准备阶段的工作安排，环境保护部环境保护对外合作中心委托湖北省环境科学研究院编制了该项目“环境管理框架”。

目前，世界银行批准了该“环境管理框架”。依据世界银行信息公开政策的相关要求，现对该报告进行公示。

公示时间：2016年7月4日至2016年7月18日

公示期间，我厅接受公众来电、来访、来信，并对所反映的问题进行调查、核实和处理。

**Figure 7-1 ESMF disclosed on Hubei EPB**





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

### 7.2.2 Public participation in the implementation of the original ESMF

During the implementation of the project, the PMOs and the execution unit carry out public participation according to the requirements of this ESMF, and establish the appeal mechanism under the project (see the appeal mechanism in the social management framework for details). As of May 31, 2021, no questions or reports from the affected persons have been received.

### Investigation and summary of stakeholders of Hubei Hengxin Chemical Co., Ltd. (January 2020, application for closure demonstration)

stakeholders	Comments	Response to comments
Hubei PMO	① Agree the enterprises to join the closure demonstration, and sign the agreement according to the procedures; ② Enterprises are required to carry out equipment removal and follow-up demonstration activities in accordance with local regulations and project requirements.	Acceptance; Follow up project activities will be carried out in accordance with local regulations and project requirements
Relevant government agencies:  Local ecological environment department	① Agree to stop production; ② The enterprise is required to dismantle the equipment and conduct monitoring according to local regulations and project requirements	Acceptance; Follow up project activities will be carried out in accordance with local regulations and project requirements
Enterprise (original) employees	① Accept the enterprise stop production, and agree to accept the job transfer training; ② No comments on other follow-up activities	According to the job transfer training plan, the staff will receive job transfer skills training

stakeholders	Comments	Response to comments
Construction unit	① No comments on the production suspension and project activities of the enterprise; ② The whole construction process will be carried out according to the Environmental and Social Management Plan and enterprise emergency plan	
Transportation unit	① No comments on the production suspension and project activities of the enterprise; ② The whole construction process will be carried out according to the Environmental and Social Management Plan and enterprise emergency plan	
Surrounding people and units	① Support enterprises to stop production; ② It is suggested that enterprises should reduce the impact on the surrounding areas in the process of demolition	Acceptance ; The Environmental and Social Management Plan and emergency plan have been formulated for the subproject, and the project activities will be carried out in strict accordance with the above plans and strive to minimize the impact on the surrounding environment.

**Investigation and summary of stakeholders of Hubei Youshida Technology Co., Ltd. (January 2020, application for closure demonstration)**

stakeholders	Comments	Response to comments
Hubei PMO	① Agree the enterprises to join the closure demonstration, and sign the agreement according to the procedures; ② Enterprises are required to carry out equipment removal and follow-up demonstration activities in accordance with local regulations and project requirements.	Acceptance; Follow up project activities will be carried out in accordance with local regulations and project requirements
Relevant government agencies:  Local ecological environment department	① Agree to stop production; ② The enterprise is required to dismantle the equipment and conduct monitoring according to local regulations and project requirements	Acceptance; Follow up project activities will be carried out in accordance with local regulations and project requirements
Enterprise (original) employees	① Accept the enterprise stop production, and agree to accept the job transfer training; ② No comments on other follow-up activities	According to the job transfer training plan, the staff will receive job transfer skills training
Construction unit	① No comments on the production suspension and project activities of the enterprise; ② The whole construction process will be carried out according to the Environmental and Social Management Plan and enterprise emergency plan	

stakeholders	Comments	Response to comments
Transportation unit	① No comments on the production suspension and project activities of the enterprise; ② The whole construction process will be carried out according to the Environmental and Social Management Plan and enterprise emergency plan	
Surrounding people and units	①Support enterprises to stop production; ②It is suggested that enterprises should reduce the impact on the surrounding areas in the process of demolition	Acceptance ; The Environmental and Social Management Plan and emergency plan have been formulated for the subproject, and the project activities will be carried out in strict accordance with the above plans and strive to minimize the impact on the surrounding environment.

### 7.2.3 Public participation of restructuring and environmental impact

During restructuring activities, project team has communicated with some stakeholders from April to June 2021. The main criterias to select stakeholders are: 1) people/institutions who have influence on the project, such as industry authorities and government departments; ② people/institutions affected by the project, such as the private sector, disposal units, etc; ③ people/institutions who care about the project or have policy and technical opinions, such as associations, experts, etc

The selected stakeholders mainly focus on waste collection and disposal, and from industry associations, industry/enterprise authorities, PPMO, hazardous waste disposal units, technology providers, etc, providing the policy and technical advice, and estimate industry willingness and feasibility.

through project activity expert seminar, potential contractors communication meeting, etc, to master the industry information, understand the potential impact scope of the activities, complete the design and budgeting of project activities, and assess the environmental and social impact intensity.

### Preliminary investigation and summary of stakeholders

stakeholders	Comments	Response to comments
Shenyang academy of Environmental Science	No objection to the activity requirements; It is suggested to organize research on typical domestic fluorine-containing waste disposal enterprises for reference of this project.	The project will organize field visits, which will be conducted from May to June 2021.
Guangdong PMO	Support implementation of the activity in Guangdong Province; It is suggested that the activities in Guangdong Province should be completed within the province by local disposal units, which does not involve trans provincial transfer of hazardous wastes	Acceptance; Hazardous wastes in Guangdong Province will be entrusted to qualified enterprises within the province

<b>stakeholders</b>	<b>Comments</b>	<b>Response to comments</b>
Typical foam extinguishing agent manufacturers (Huiyou, Suolong)	Support activities; no objection	According to the work plan, continue to solicit opinions after the completion of hazardous waste disposal TOR
China Surface Engineering Association (Electroplating Association)	Support activities; no objection	Acceptance
China Certification Center for Fire products	Give the demonstrations sites a priority in expired firefighting foam collection and disposal	According to the actual situation of public solicitation

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## **Annex 1: Term of Reference for Environment and Social Assessment and Environment and Social Management Plan**

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 obligations in phasing out of PFOS and its salts, as is stated in Stockholm Convention on POPs.

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, some participating enterprises/agencies need to conduct ESIA and prepare Environmental and Social Management Plan (ESMP). The section below will provide the road map and guidance for ESIA/ESMP based on domestic ESIA requirements and the WB’s OP4.01 as well as World Bank Group General Guidelines for Environment, Health and Safety(EHS), as well as EHS Guidelines for Semiconductor and Other Electronics Manufacturing Industries. This TOR will stipulate in detail many aspects of the environmental assessment, including the objectives and scope of tasks, expected results, assessment methods and technical requirements, etc. The detailed tasks and requirements are as below.

### **Task 1 Project Description**

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

### **Task 2 Baseline investigation**

Baseline data and maps will be collected, included the construction master plan, feasibility study reports and preliminary design reports, ESIA reports and approvals, construction completion report (if available), environmental audit report (if available), clean production audit reports (if available) and etc.

#### **2.1 The current status of regional natural & social environment:**

- 1) **Natural environment.** Including geology, geomorphology, meteorology, climate, hydrology, hydrology, and distribution of natural heritages (if relevant) and nature reserves (if relevant).
- 2) **Social environment.** Including regional economy development, location & population of residential areas, scale of enterprises and institutions, direction and distance from the conversion project of PFOS production enterprises, distribution of cultural heritage sites (if relevant) , etc.
- 3) **Regional pollutant sources.** Especially areas where aquatic environment, atmospheric environment and environment carrying capacity is limited.
- 4) **Environmental functional zoning and ecological function zoning, etc.**

#### **2.2 Baseline investigation/environmental audit of enterprise:**

Baseline data investigation is equivalent to environment audit (See Annex 2 for details on requirements) for the project entities. The baseline data collection includes but not limited to:

development history of the entities, operations, introduction, primary process, production, scale and the status. Baseline survey will cover all aspects, including components of production shops (or facilities) & auxiliary facilities; production scale, production methods and product categories of production shops (or facilities); product categories and production and varieties and consumption of materials and auxiliaries; consumption of public utilities (e.g. water, electricity, steam) in auxiliary facilities. Identify relevant environmental and

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occupational health and safety legislation in the national regulation and with the World Bank. The baseline survey can be one of the focuses for simplified ESIA.

### **Task 3: Assess the environmental, health and safety impacts**

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. This includes the impact from construction dust, noise, wastewater, construction camp sewage and garbage, spoil from construction activities, and construction vehicles, occupied road, temporary land occupied, on the surrounding environment, and the influence during construction period on the road, for community residents to travel around the project area.

#### **(3) Operation period**

For enterprises undertaking transformation, it shall focus on the environmental and occupational health and safety impact assessment of various factors. For POPs and specific pollutants emitted in production, the enterprise can carry out monitoring and investigation to find out their impact on environmental sensitive spots. At the same time, the analysis shall focus on the adverse effects of project, so as to find out the environmental sensitive spots.

##### **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 impact on 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**

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- 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 project affected people (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. Check and ratify the amount of pollutants reduced by measures for technical modification project.

#### **5) Occupational health and safety**

- a) Assess impact on internal controls, management procedures and practices for dealing with the environmental, safety and health issues at hand. Assess impact on procedures and rules for employee protection and medical examination availability for employees with potential exposure to dangerous substances; evaluate adequacy of training and emergency drills; assess hazards or risks for local community, etc.
- b) Examine significant risks including chemical use, waste management, risk of soil and ground water contamination, and fire and explosion risks.
- c) Assess that hazardous operations are separated from harmless ones and separate workplaces with toxic substances from other workplaces. The workplaces with toxic substances will be set up with yellow warning lines, signals and Chinese descriptions, indicating the species, consequence, prevention and contingency measures of the toxic substances; The workplaces of highly toxic substances will be set up with red warning lines, signals and Chinese descriptions of the toxic substances and communication and warning devices must be equipped.
- d) Assess impact on efficiency of ventilation for toxic substances; and adequacy of automatic alarms and accident ventilation facilities. The workplaces with highly toxic substances will be set up with emergency exit and necessary risk-elimination areas.
- e) Assess that protective products, qualified to national vocational sanitary standards, will be provided by the enterprise to those who use toxic substances in working process. The enterprise also should ensure the workers use the protective products correctly.

#### **Task 4: Alternative Analysis**

The purpose of alternative analysis is to help optimizing project design from environmental perspective, not to prove the selected design. The alternative analysis is designed to bring environmental and social consideration into the upstream stages of development planning-project identification.

Systematically compare different alternatives to the proposed project in terms of 1) environmental impacts, 2) production process/production technology alternative analysis, 3) feasibility of mitigating these impacts, 4) their capital and recurrent costs, 5) their suitability under local conditions and 6) their training and monitoring requirements.

The alternative scenario includes but is not limited to: No-action scenario, feasibility study not of selected scenario, and new raised scenario proposed from the public

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consultation.

### **Task 5: Information disclosure & public consultation**

According to WB policy, at least two rounds information disclosure should be conducted: 1) after the completion of the ESIA outline (first round); 2) after draft for ESIA report is completed (second round). Public consultation should be carried out in an effective manner after full information disclosure.

For Category-A project, the PMO/PIU needs to consult project-affected groups and local nongovernmental organizations (NGOs) about the project's environmental aspects and take their views into account. For Category A projects, the borrower consults these groups at least twice: (a) shortly after environmental screening and before the terms of reference for the EA are finalized; and (b) once a draft EA report is prepared. In addition, the borrower consults with such groups throughout project implementation as necessary to address EA-related issues that affect them. The public consultation approaches include household and individual interview, discussion meeting and questionnaire. The survey shall focus on affected masses rather than local government officials.

In **first round**, the public consultation, project information and potential environmental issues should be disclosed to PAPs. In **second round**, all ESIA 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 ESIA 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 ESIA report must record how PAPs' concerns, opinions and suggestion are treated.

### **Task 6: Preparation of ESMP**

#### **1. Institutional arrangement**

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. Summary of impacts**

The predicted adverse environmental and social impacts for which mitigation is required should be identified and briefly summarized. Cross-referencing to the EA report or other documentation is recommended, so that additional detail can readily be referenced.

#### **3. 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 WBG's "General Environment, Health and Safety Guidelines" (referred to as the "EHS Guidelines").

#### **4. Monitoring program**

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.

## 5. Capacity building and training programs

It aims to familiarize project stakeholders with ESMP, 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.

## 6. Monitoring and reporting system

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

Table 1-1 List of environmental management system

Phases	Project stakeholders	Environmental duties	Notes
Design and preparation phase	PIU and/or PMO		
	DI		
	ESIA units		
	Other		
Construction period	PIU and/or PMO		
	Contractors		
	Engineering/environmental supervision		
	Local EPA		
	Others		
Operation period	PMO		
	PIU and operating units		
	Environmental monitoring unit		
	Operation-related competent authorities		
	Other relevant administrative departments		

Table 1-2. List of environmental impacts and mitigation measures

Phases	Main activities	Negative impacts	Mitigation/contr ol measures	Cost estimates	Executor	Superv isor
Design and preparation phase						
Construction period						
Operating period						

## 7. Cost estimates and sources of funds

These should be specified for both the initial investment and recurring expenses for implementing all measures contained in the ESMP, integrated into the total project costs, and factored into loan negotiations.

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## **Task 7: Executive Summary**

Concisely discuss significant findings and recommended actions.

### **Qualification requirements for consulting units**

The Consultant must be familiar with domestic laws, regulations and technical requirements of ESIA. Meanwhile, they should also have ESIA qualifications of chemical and electroplating industry. In addition, they should be experienced in preparing ESIA in accordance with WB requirements, which will be beneficial for the project implementation.

### **Appendix - Outline of ESIA Report**

1. Executive Summary
2. Policy, Legal, and Administrative Framework
3. Project Description
4. Baseline Investigation
  - 4.1 The current status of regional natural & social environment
    - 4.1.1 Natural environment
    - 4.1.2 Social environment
    - 4.1.3 Environmental quality and functional zoning
  - 4.2 Baseline data investigation on the enterprises (environment audit)
5. Environmental and Health and Safety Impacts
  - 5.1 Design period
  - 5.2 Construction period
  - 5.3 Operation period
    - 5.3.1 Atmosphere
    - 5.3.2 Water
    - 5.3.3 Acoustic noise
    - 5.3.4 Environmental risk assessment
    - 5.3.5 Occupational health and safety
6. Alternative Analysis
7. Information disclosure & public consultation
8. Environment Management Plan
  - 8.1 Institutional arrangement
  - 8.2 Summary of impacts
  - 8.3. Mitigation measures
  - 8.4 Monitoring program
  - 8.5 Capacity building and training programs
9. Conclusions

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## **Annex 2: TOR for environmental audit**

The environmental audit is a process to assess whether the facility and its operation conditions comply with relevant regulations, standards and policies. If any gaps are identified in the audit, corresponding mitigation measures and monitoring arrangements should be developed in the forms of an Environmental and Social Management Plan.

Currently there are no specific national guidelines for environmental audit in China, but some training material commonly accepted and used by practitioners. The Bank issued guidance on ***Environmental Auditing*** in the Environmental Assessment Sourcebook Update in 1995. Based on the EA Sourcebook, an **Environmental Audit** is a methodical examination of environmental information about an organization, a facility, or a site, to verify whether, or to what extent, they conform to specified audit criteria. The criteria may be based on local, national or international environmental standards, national laws and regulations, permits and concessions, internal management system specifications, corporate standards, or guidelines of organizations such as the World Bank. The detailed requirements and contents of this TOR are developed with reference to domestic and international practices.

### **I Main tasks and relevant requirements of environmental audit**

#### **Task 1 Baseline survey**

##### **(1) Basic situation of enterprise**

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. Identify relevant environmental and occupational health and safety legislation in the national and the World Bank.

##### **(2) Basics of the project activities**

- 1) Basic situation: scale of project, products scheme (including main product and byproducts), investment, location, etc.
- 2) Component of project: The engineering content (main engineering, auxiliary engineering, environmental engineering, storage and transportation engineering and supporting engineering) is complete and has no omissions. Pay attention to the analysis of storage and transportation engineering. Indicate the engineering content directly associated with project construction.
- 3) Consumption of materials and energy: Clearly indicate the species and amount of raw materials, affiliated materials, fuel, and water to be consumed for the project. The unit consumption and total consumption will be clearly defined. List the content of toxic materials in main raw materials, affiliated materials and fuel.
- 4) Production and emission of pollutants: For the pollution generation and emission, audit whether this kind of material is in accordance with the emission standards on the aspects of emission manner, concentration and emission amount. Provide comments and suggestions on auditing.
- 5) Other outstanding environment issues (such as soil and underground water pollution) will also be focused on, such as the nature, influences of the environmental issue and possibility of resolutions.

#### **Task 2 Implementation of ESIA and the relevant regulations**

**“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 or left in idle without permission.

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

2. Verify compliance with host country laws and regulations, World Bank guidelines or accepted international standards for all important environmental impacts.

(1) Procedural audit mainly refers the audit of whether ESIA 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. Procedural audit shall cover the implementation of ESIA 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 ESIA document and approval document, environmental acceptance and survey document and acceptance remarks. Physical audit 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 ESIA 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:

1) 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 ESIA approval document.

2) 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 ESIA approval document and the requirements on environmental protection in the production approval document one by one.

3) For project in progress, analyze and find out whether the environmental activities during the construction process meet the requirements of ESIA, including other requirements to be implemented by stages specified in the ESIA and ESIA 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 ESIA and “three parallel implementations” system or not implementing the requirements on environmental protection as per the approval, and rectification shall be performed.

4. For the cleaner production of the enterprise: Whether cleaner production and audit will be carried out, whether audit results will be adopted, as well as the energy consumption of some unit in the enterprise.

### **Task 3. Discharge of main pollutants and characteristic pollutants**

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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 ESIA 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.

Non-compliance 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; and
- 4) Only the measured data provided by the enterprise is available.

If any state or local standard for pollutant discharge is changed in the audit period, the new

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standard shall be adopted. Finally, demonstrate whether the enterprise can keep the stable up-to-standard discharge of pollutants by considering the operation status of environmental protection facilities; and in case of failing to keep the stable up-to-standard discharge, explain the reasons and propose improvements.

#### **Task 4. 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 environmental audit include: the completeness of supporting environmental protection facilities, the reliability of technology and capability of the facilities, the operation status of the facilities.

#### **Task 5. Control of pollution from 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 signed 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.

#### **Task 6 Disposal of hazardous wastes and general industrial wastes (if applicable)**

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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:
    - (a) Whether the waste treatment capacity of the storage facilities and landfill is sufficient for the production quantity of solid wastes;
    - (b) 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.

**Task 7 Environmental safety risks, emergency response plan, and environmental incidents incurred (if applicable)**

1. Examine 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;
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.

**Task 8. Occupational health and safety**

- 1) Assess adequacy of internal controls, management procedures and practices for dealing with the environmental, safety and health issues at hand. Examine procedures and rules for employee protection and assess the compliance level with company policies; evaluate accident or incident reporting, analysis and follow-up; check medical examination

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availability for employees with potential exposure to dangerous substances; evaluate adequacy of training and emergency drills; examine record of complaints and assess hazards or risks for local community, etc.

- 2) Examine significant risks including chemical use, waste management, risk of soil and ground water contamination, and fire and explosion risks.
- 3) Check the companies conducted the health examinations and leakages, which should be available centrally and at all points of use; Check whether the enterprise has conducted occupational health education and trainings in a regular manner. Solicit comments and suggestions of staff on prevention of occupational disease by way of interviews or questionnaire surveys.
- 4) Review the complaints and the records on the storage of dangerous substances and hazardous solid waste management.
- 5) Separate hazardous operations from harmless ones and separate workplaces with toxic substances from other workplaces. The workplaces with toxic substances will be set up with yellow warning lines, signals and Chinese descriptions, indicating the species, consequence, prevention and contingency measures of the toxic substances; The workplaces of highly toxic substances will be set up with red warning lines, signals and Chinese descriptions of the toxic substances and communication and warning devices must be equipped.
- 6) The workplace with toxic substances will be installed with efficient ventilation facilities; as for the workplaces with potential leakage of toxic substances, or may lead to acute positioning, the automatic alarms and accident ventilation facilities will be installed. The workplaces with highly toxic substances will be set up with emergency exit and necessary risk-elimination areas;
- 7) The protective products, qualified to national vocational sanitary standards, will be provided by the enterprise to those who use toxic substances in working process. The enterprise also should ensure the workers use the protective products correctly.

## **II. Methods and requirements of enterprise survey**

Date survey and on-the-spot survey of 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 complementarily 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;

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- 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.

Requested the 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 2-1 New, reconstruction and expansion projects in the audit period**

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

**Table 2-2 Summary of environmental sensitive spots near the enterprise**

Name	Location	Distance (m)	Size	Remarks:

**Table 2-3 Control measures of industrial exhaust pollution**

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

**Table 2-4 Treatment and disposal of hazardous wastes**

Type of wastes	When produced	Temporary storage place/facilities	Comprehensive utilization		Other 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 2-5 List of Major Dangerous Chemicals Used**

No.	Goods & materials	Usage	Hazardous chemicals or not	Highly toxic chemicals or not?
1				
2				
...				

**Table 2-6 Summary of Pollution Discharge**

Procedure of Pollution Generation		ESIA suggestions and Treatment Measures	Actual Conditions and Benefits	Suggestions and Recommendations of Environmental Audit
<b>Waste water</b>	Production Wastewater			
	Cleaning Wastewater			
	Domestic Wastewater			
	Rainstorm			
<b>Exhaust gas</b>	Boiler Exhaust			
	Feature Air Pollutant 1			
	Feature Air Pollutant 2			
	.....			
<b>Noise</b>	Noise of Plant			
<b>Solid Waste</b>	Distillation residue			
	Domestic Waste			
	Hazardous Waste			
	Feature Solid Waste 1			
	Feature Solid Waste 2			
	.....			
<b>Risks and Accidents</b>	Fire and explosion in the production equipment			
	Leakage of reaction liquid in the production equipment			
	Gas leakage in the production equipment			
	Negligence of Production management			
	Fire and explosion due to improper design of chemical warehouse			
	Fire and explosion due to improper warehouse equipment management			
	Oil Spill			
	Fire and explosion due to improper fire source management during storage			
	Fire and explosion emergency of warehouse			
	Fire and explosion during transportation.			
	Malfunction of WWTP			
	.....			
	<b>Others</b>	Greening of plant area		
Map of plant layout				
Standardization of sewage outfall				

**Table 2-7: Implementation Status of Enterprises on Environmental Technology**

<b>Environmental Accidents and Pollution Disputes</b>		
1	Profile	Time: Place: Causes: Process of dispute resolution: Response of enterprise: Results:
	Implementation status of disputes resolution	Status of implementation (already implemented, not implemented and reasons)  Status of main rectification facilities (name, model, scale, construction time, processing):
2	Profile	Time: Place: Causes: Process of dispute resolution: Response of enterprise: Results:
	Implementation status of disputes resolution	Status of implementation (already implemented, not implemented and reasons)  Status of main rectification facilities (name, model, scale, construction time, processing)
3	Profile	Time: Place: Causes: Process of dispute resolution: Response of enterprise: Results:
	Implementation status of disputes resolution	Status of implementation (already implemented, not implemented and reasons)  Status of main rectification facilities (name, model, scale, construction time, processing)

### **3. Qualification requirements for consulting units**

EA Consultant must be familiar with laws and regulations of national ESIA, technical standards and requirements related to environmental audit, with experience in environmental audit. In addition, experienced with WB projects and requirements will be beneficial.

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### **Annex 3: TOR for Environmental Site Assessment**

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 site pollution and the long-term potential impact in accordance with requirements of China and the World Bank. Meanwhile, the remediation measures need to be put forward in accordance with the future possible usage of the site, if known.

The TOR 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 Ecology and Environment 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<sup>2</sup>**

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 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

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<sup>2</sup>Cite Page 9-10, Page 12-13 of *Guidelines for Environmental Survey, Assessment and Restoration of Industrial Enterprise Site* (trial).

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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 is 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.

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### **3 Main tasks and the requirements**

Before carrying out the survey on polluted site, first, we review the operation status before the plant is closed. The detailed requirements and procedures for such review can be referred to Annex 2, and more simplified than regular environmental audits. Meanwhile, to dismantle equipment is also supported by the project. Before this, we will analyze the risks and impacts of dismantling equipment by comparing with the list of equipment to be dismantled. More details see section 3.4.4 on development of EMP.

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 Objective and Scope**

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 scopes 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:

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### **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 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.

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#### **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 field 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

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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:**

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- 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 scopes**

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 scopes 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.

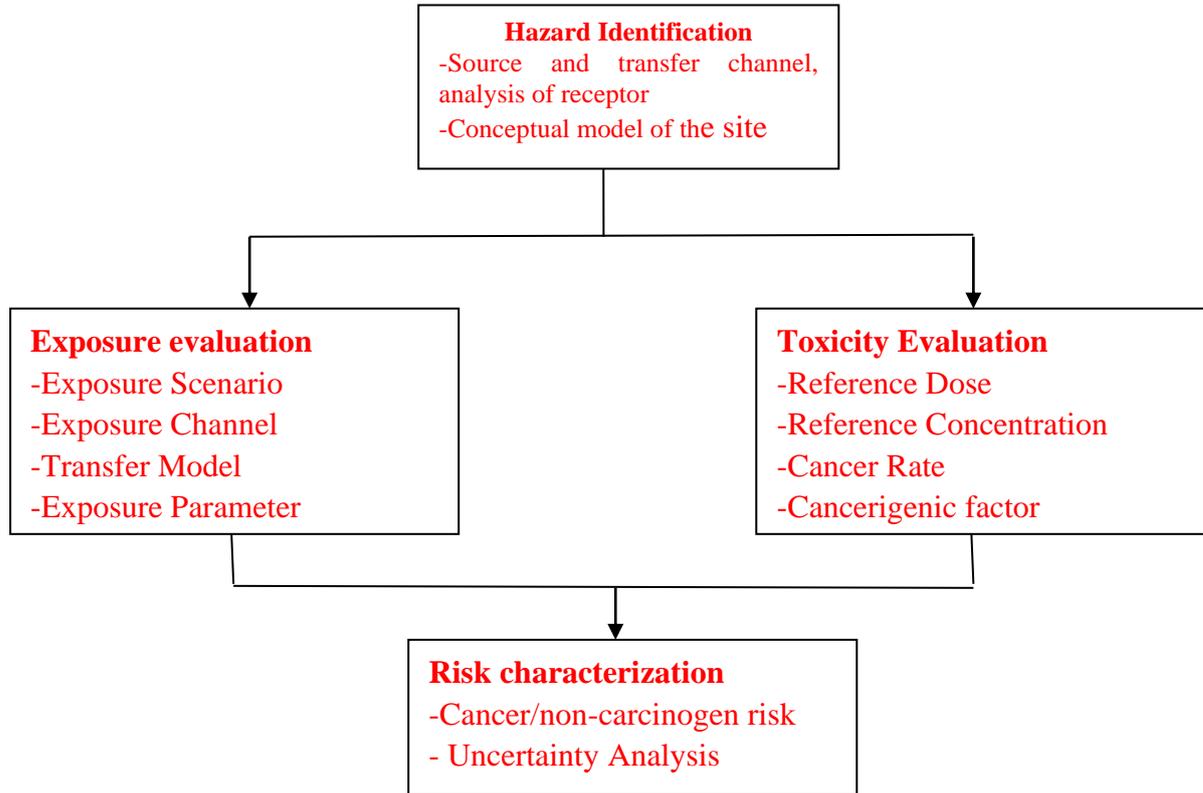
## **Task III: The third stage of survey-risk assessment**

### **3.3.1 Objective and scopes**

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.



**Figure 3.1 Work Procedure of Pollution Site Risk Assessment**

#### 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.

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(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.

### **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 scopes 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

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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

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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 and Social 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 and Social Management Plan**

Based on the site assessment, a series of suggestion and measures will be proposed for the equipment demolishing and urgent preliminary clean up if needed, together with the monitoring requirements. These will form an EMP. If the future use of the land can be determined during project implementation, the EMP can also provide guidance on measures for the site remediation and restoration, which is also termed as site restoration plan.

Below are the potential risks and environmental impacts during dismantling:

- Fire and explosion: When dismantling technical pipeline and equipment (construction out of the container), sulfuric acid and combustibles, reductant, alkali, alkali metal and hazardous chemicals may come into intense reactions; diluted acid and some metals may come into reaction to generate hydrogen, or come into neutralization reaction with alkali, burning; There may exist oil and gas in the

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pipelines and equipment, combustible.

- Burning: When dismantling technical pipelines and equipment, no protective products are worn or there is residual acid in the pipeline or equipment.
- Object strike: When dismantling technical pipelines, equipment (out of the container) or steel structures, the dismantled pieces are not placed stably, or the operation staff is not following the standard operating requirements.
- Falling from upper air: When dismantling technical pipelines, equipment (out of the container) or steel structures, the materials are not qualified or fully inspected, or scaffolding erection is not in accordance with the requirements, or the protective equipment has some defects, or the staff is not taking personal prevention in accordance with standards resulting in falling-off of people or objects, or the pieces are not be well-fixed because the construction after rain and surface of structure is quite easy to get loose.
- Damage due to falling objects: When dismantling technical pipelines, equipment (out of the container) or steel structures, the protective measures for laborers are not standard, or no available isolation measures are provided for cross-operation, or the operation is not appropriate for the operating procedures.
- Damage due to lifting: When dismantling technical pipelines, equipment (out of the container) or steel structures, the operating instructions are not proper, or the machines and tools are not qualified or misused, or overloading, or the accessories of lifting objects are not well-fixed, or the debris are not cleaned and the lifting machines loses balance;
- Electric shock: When dismantling technical pipelines, equipment (out of the container) or steel structures, there are defects in the electrical equipment and machinery. The specification or installation is not as required; the electrical facilities and circuits are damaged; the operation is not in accordance with the requirements, or the safety protection products are not applied.
- The following will have adverse impacts on the environment: dust, solid wastes, leakage, dusting of construction, spill during transportation, various scraps during construction, general industrial solid wastes and domestic wastes, residual medium in the container and pipelines during dismantling, leakage of oil and gas medium, wastewater after cleaning acid storage tank and pipelines.

Therefore, risk analysis is required before dismantling equipment and containers. Also prepare mitigation and emergency control measures and provide technical support to the construction staff so that they understand the existing hazards, countermeasures and methods to handle hazards and emergencies. As there may be combustible and explosive chemicals such as residual organic solvent in the production device and pipelines, we need to dispose them before dismantling, e.g., steam purging to the pipelines and equipment inside the device, displacement by inert gas such as nitrogen, to ensure that no residual medium are left. As for the equipment, containers and pipelines which may remain hazardous chemicals, clean first and then dismantle upon being qualified by chemical testing. The cleaning wastewater will be transported by pipelines or tankers to the WWTP to be charged after meeting the standards. The workers must wear necessary safety protective suits, equip the fire control tools, wear rubber acid and alkali-resistant gloves and follow the operating regulations strictly during construction.

The EMP provides guidance for implementation of restoration of the target site, prevent the second pollution of the site during restoration process and provide technical support

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for environmental monitoring and management in the restoration process. Preparation of EMP 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. Format for site assessment report**

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

- 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 pipelines and pollution
    - 4.1.6 Operation, usage and instrumentation in labs
    - 4.1.7 Log sheet of main infrastructures
  - 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)**

- 1 Overview
- 2 Survey report of the first stage –Identification of pollution
- 3 Survey of the second stage—on-the-spot sampling
  - 3.1 Sampling plan
  - 3.2 Initial sampling of pollutants and analysis
  - 3.3 Detailed sampling and analysis

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- 3.4 Hydrogeological investigation and geotechnical test
  - 4 Site risks selection
  - 5 Conclusions and suggestions

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## **Annex 4 Pest Management Plan**

### **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 Perfluorooctane sulfonic 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.

### **2. Red Imported Fire Ant and its Damage**

#### **2.1 Red Imported Fire Ant and its Distribution in China**

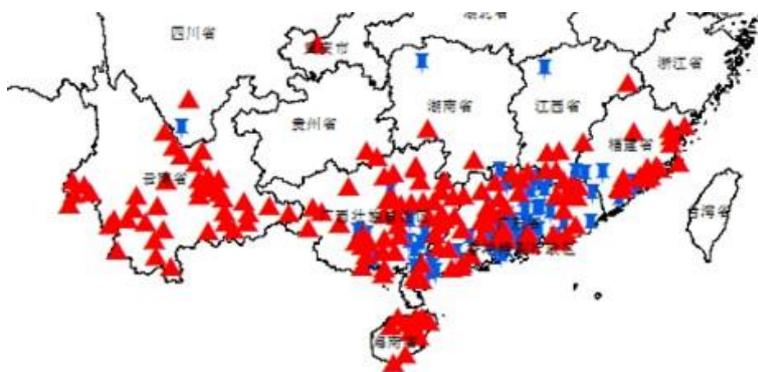
Red imported fire ant (RIFA), *Imported fire ant* (Buren) is native to South America and is believed to have been distributed along the Parana River passing through Brazil, Paraguay and Argentina. The ant can spread naturally with wind and water ways and with human related activities such as transport 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

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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<sup>3</sup> (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 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 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.

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<sup>3</sup>Namely Guangdong, Guangxi, Fujian, Hainan, Yunnan, Jiangxi, Hunan, Sichuan, Chongqing and Guizhou.

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***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.

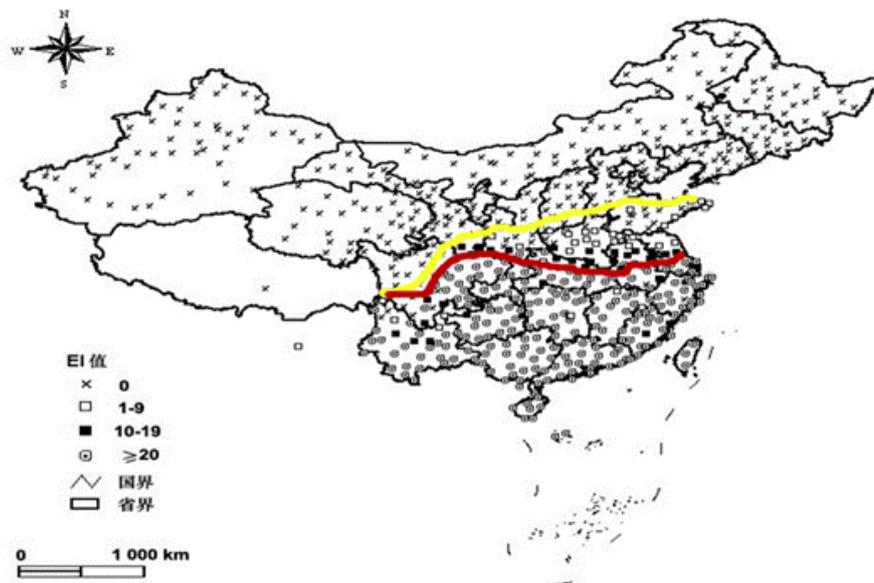
***Impact on Public Safety.*** Since RIFA can be attracted by magnetic field in the current, it is habituated to build ant nests near the electrical equipment, such as that electricity meter, telephone exchange case, traffic electromechanical equipment boxes, airport runway indicator lights and air-conditioner 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 Occurrence Prediction on Red Imported Fire Ant**

RIFA can survive in areas with a broad range of average annual temperature. 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 are 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.

## 2.4 Regulatory and Institutional Framework

### 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

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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 specified 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.

### **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.

### **Technical Standards**

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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).

### **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

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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.

### **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.

### **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

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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.

The WBG Environment, Health and Safety Guidelines for Annual Crop Production outlines environment protection standards and practices for pesticide use. Most of requirements for the application, transportation and storage of insecticides and the precautionary measures to prevent chemical hazard cause by handling insecticides are equivalently stipulated in national laws, departmental rules and technical standards in China, e.g. encouraging the use of substitutive measures for pesticides, requiring delivery training to pesticide applicators, requiring use of registered pesticides and adopting necessary safety intervals for pesticide use. The gaps largely remain in two areas. One gap is that there are no provisions yet for a few requirements for use and precautionary measures, e.g. market access management has not been established for pesticide spraying facilities and there is no licensing requirement for pesticide applicators. Another gap lies in the area of implementation of some requirements, e.g. non-registered pesticides are sometimes sold on market and all pesticide applicators cannot be included in training program because there are too many players in pesticide distribution and applications.

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

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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*, the licensing system for pesticide selling will be established by the revised Regulation for Pesticide Management and as a result the pesticide market can be more effectively regulated. The project can promote the promulgation of the policy for the registration of pesticides for special purpose by incorporating specific studies and expert workshops, and can also strengthen awareness of relevant laws and regulations by compiling science popularizing books and shooting TV programs. More important, the training of pesticide applicators can be included as an important element of the project so that more people can better understand relative requirements and hence take precautionary measures properly. 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.

### **3 Institutional Capacity**

#### **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.

#### **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<sup>4</sup> 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

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<sup>4</sup>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.

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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 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.

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**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

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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 centrally 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.

### **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.

### **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 suitably qualified plant protection organization can be contracted 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,

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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.

## **4 Major Control Measures of Red Imported Fire Ant**

### **4.1 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,

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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 is 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<sup>2</sup>. 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

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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 baiting 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, organophosphates 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, organophosphates 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 diameters between 20~40cm while 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, powder 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.

## **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

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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).

## **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 31 formulated 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**

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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 nerifolia* etc. and tested for their effect on controlling RIFA. The pathogenicity of fungi including *Beauveria bassiana*, *Metarhizium anisopliae* and *Metarhizium flavoviride* were also studied. However, those efforts were limited in laboratory experiment and no commercial products are available up to now.

## **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 including fungi (e.g. *Thelohania solenopsae* and *Beauveria bassiana*), nematodes (e.g. *Steinernema* spp. and *Heterorhabditis* spp) and parasitic insects (e.g. *Pseudacteon* spp.,

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*Oraesema* 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 in 98% of the treated areas after the two-phase method was applied.

### **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

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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.

## **Use and Management of Pesticides**

### **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 imidacloprid are 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 indoxacarb active ingredient respectively, and one has spinosad and imidacloprid respectively as active ingredient. Alpha-cypermethrin is used as the active ingredient in the only one powder.

**Table 4-1. Types of Pesticides Registered for RIFA Control**

(As of March 2016)

SN	Company name	Active ingredients and 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 Luoding Yong'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 eaten 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 eaten 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 ingredients and 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

## 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 hydramethylnon) 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 public health insecticides for indoor use<sup>5</sup> 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.

**Table 4-2. 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 <sup>6</sup>	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

<sup>5</sup> 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.

<sup>6</sup> 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 sulfluramid will have to pause when the exemption period expires in 2019.

SN	Types of Pesticide	Technical Characteristics	Control Cost	Policy Constraints	Toxicity grading of formulation	Comprehensive Evaluation
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	0.5% sulfluramid plus 0.05% fipronil 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
12	0.05% 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 areas will be built under the project (see Chapter 6), each demonstrative area will cover an area of 500 Mu (666.7 m<sup>2</sup>) 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.

### Risk Control of Target Environment and End Users of Pesticides

Indoxacarb, alpha-cypermethrin and hydramethylnon all pose environment risk and alpha-cypermethrin is especially toxic to aquatic organisms (see table 4-3). Some adverse impacts on the end users mainly include:

1. Risks of environmental pollution: these three kinds of agents are all poisonous to some extent. 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<sup>7</sup> 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

<sup>7</sup> 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.

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.

2. Risk of damaging end users. With targeted measures for control of red fire ants, the risks of drifting and that users inhaling pesticides are low. However, improper operation, such as accidentally inhalation or contact with eyes, may also do harm to the end users. In order to prevent from the risks as listed above, the project will take the following measures for environmental protection and for the safety of end users:

First, prepare guide on the usage of alternative agents;

Second, select demonstration spots carefully. The location will be proposed initially by local plantation department and then determined by the specialists' team engaged by provincial plantation department.

Third, engage professional prevention and control agency to organize how to apply pesticides. The users are required to be equipped with protective equipment and follow the pesticide application method properly.

Fourth, necessary trainings will be provided to relevant staff before demonstration, to help them understand security measures and safety requirements.

Fifth, local plantation agencies will arrange experts to provide guidance and inspections on-site for pesticide application. Anything not in compliance with safety requirements will be corrected immediately.

**Table 4-3. 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.

### **Control of Risk during the Transportation, Storage and Distribution**

The baits of indoxacarb and hydramethylnon and 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.
- 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 is 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:

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- 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.
  - 5) Arrange experts to provide inspection and guidance on the transportation, storage and sales of pesticides. Anything not in compliance with safety requirements will be corrected immediately.
  - 6) The provincial plantation department will recycle the remaining pesticides to be transferred to WWTP with the qualification of HW04 hazardous chemical treatment for incineration treatment.

### **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.

### **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.

### **Area of Reduction of Sulfluramid Use**

#### **1. Demonstration of Alternatives**

Demonstration areas are established in 5 provinces including Guangdong, Guizhou, Fujian, Guangxi and Hainan 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 Guizhou 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 a suitably qualified plant protection organization. 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

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implementation plans every year to set clear the procedure and requirement for the demonstration.

The total budget is estimated at 2,734,000 US dollars among which approx. 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 Imported 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 estimated at 1,013,125 US dollars among which approx. 225,110 US dollars need to be provided by GEF.

## **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 estimated at 84,400 US dollars among which approx. 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 estimated at 45,200 US dollars among which approx. 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 estimated at 393,020 US dollars among which approx. 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 estimated at 120,460 US dollars among which approx. 43,380 US dollars need to be provided by GEF.

### **4. Built-up of National Capacity**

#### **(1) Amendment of Rules for Chemical Control Technologies of RIFA.**

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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 estimated at 49,160 US dollars among which approx. 20,940 US dollars need to be provided by GEF.

### **(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 estimated at 78,800 US dollars among which approx. 25,700 US dollars need to be provided by GEF.

### **(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 estimated at 78,800 US dollars among which approx. 25,700 US dollars need to be provided by GEF.

## **5. Training**

### **(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 centrally 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 centrally conducted in different counties of RIFA occurrence with 37,650 township officials and village leaders as participants in the 5 demonstration provinces.

### **(2) Training Contents**

The training mainly contains the followings:

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

### **(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.

### **(4) Training Budget**

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

**Table 7-4. The Training Plan and Estimated 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 1 <sup>st</sup> year of the project	totally 352,920 with 194,640 from GEF
		Second grade	16,000	320 courses conducted in 3 years from the 2 <sup>nd</sup> 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 1 <sup>st</sup> year of the project	totally 117,640 with 64,880 from GEF
		Second grade	5,000	100 courses conducted in 3 years from the 2 <sup>nd</sup> 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 1 <sup>st</sup> year of the project	totally 205,870 with 113,540 from GEF
		Second grade	8,100	62 courses conducted in 3 years from the 2 <sup>nd</sup> 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 1 <sup>st</sup> year of the project	totally 58,820 with 32,440 from GEF
		Second grade	1,800	36 courses conducted in 3 years from the 2 <sup>nd</sup> year of the project	totally 695,820 and all provided by counterpart funds
	Guizhou	First grade	300	6 courses conducted in 4 years from the 1 <sup>st</sup> year of the project	totally 176,460 with 97,320 from GEF
		Second grade	6,750	135 courses conducted in 3 years from the 2 <sup>nd</sup> 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 1 <sup>st</sup> year of the project	totally 197,640 with 64,880 from GEF

## Supervision and Evaluation

### 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 suitably qualified plant protection organization. All the other activities will be packaged and contracted to the national plant protection organization. The provincial plant protection stations in Guangdong, Guangxi, Guizhou, Fujian and Hainan 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.

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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 estimated at 906,175 US dollars among which approx. 371,620 US dollars need to be provided by GEF.

### **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 estimated at 246,185 US dollars among which approx. 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, Guizhou and Hainan. The total budget is estimated at 505,000 US dollars and all need to be provided by GEF.

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## **Part II Social Management Framework**



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## 1. Introduction to the Project

The Global Environmental Objective (GEO) of the proposed project is to help China with PFOS production and emission reduction in application industries. Through the implementation of the project, PFOS will be reduced by at least 44 tons in production and application, significantly reducing the emission of POPs, reducing environmental risks. Additionally, the supervision capacity of relevant management agencies and public awareness of reducing POPs will be enhanced, bringing positive environmental benefits. The project mainly includes PFOS production industry, application industry in electroplating, red imported fire ants (RIFA) prevention and firefighting. Specifically, it includes four components:

### ***Component 1: PFOS Production Reduction***

This component is mainly carried out in Hubei, and will support production phase-out and reduction for primary PFOSF producers and at secondary PFOS producers (approximately 14 companies). Activities to be financed include: closure; conversion of production to non-POPs like chemicals.

*Conversion of production facilities:* This component will finance conversion of PFOSF production facilities and offer incentives to support downstream PFOS manufacturers in switching to new non-PFOS-based products. The project would not finance any production of chemicals known to possess persistence, bio-accumulative and toxic (PBT) characteristics. Eligible incremental expenditures would include: (a) development of non-PFOS products; (b) costs related to registration of new products; (c) equipment and technology transfer costs; (d) installation of equipment; (e) training; (f) trial production; (g) incremental costs of new raw materials, utilities, waste management; and (h) costs of disposal of contaminated equipment previously used for producing or storing PFOS.

*Plant or production line closure:* GEF incremental support would be extended to enterprises that might decide to close down their production facility altogether. GEF resources will be used to support management of environmental liabilities from such closure. Eligible incremental expenditure would include: (a) dismantling costs; (b) disposal costs of contaminated equipment and materials; and (c) consulting services to develop site risk assessment, management and monitoring plans. Remediation beyond disposal of contaminated equipment is expected to be financed by other sources outside of the Project.

### ***Component 2: Reduction of PFOS Use***

This component is mainly carried out in Guangdong and Hubei and addresses three priority sectors: chromium mist suppressants in the metal plating sector, firefighting foam sector, and pesticides for control of red imported fire ant (RIFA). The fourth large sector in terms of consumption, oil production, is addressed through TA only under component 3.

*Chrome mist suppressant in metal plating:* The Project will finance demonstration activities to showcase non-PFOS alternatives and closed-loop systems, with equivalent or improved efficacy in terms of protection of human health and safety. The demonstration activities include installations of approx. two closed-loop systems for different chrome-plated product lines. The industrial parks will be selected during the project implementation. Criteria for selection of these industrial parks would include the number of chrome plating enterprises, environmental management capacity of the industrial parks, and willingness to showcase demonstration activities to similar industry in other industrial parks.

The project will finance costs in relation to acquiring of the following: (a) upgrade of facilities to closed-loop systems; (b) chrome plating baths replacement; (c) new chromium mist suppressant; (d) other equipment, testing device, and control systems related to the use of new alternatives; (e) ventilation and safety equipment; (f) site preparation for installation of new equipment; (g) advanced treatment facilities for up to three industrial parks for removing perfluorinated compounds (PFCs) from water discharge from chrome plating industry.

*Firefighting foam:* The project will finance development and production of non-PFOS firefighting foam at 3-5 firefighting foam manufacturers. The selection criteria of firefighting foam manufacturers

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would include: (a) research and development capacity; (b) relevant experience with firefighting chemicals; (c) large network of firefighting foam clients; (d) good environmental performance record; (e) in-house capacity to develop non-PFOS surfactants or technical cooperation with reputable surfactant manufacturers; and (f) cost effective proposals.

The following costs will be covered by the Project: (a) research and development of new non-PFOS based firefighting foam; (b) environmental and health impact evaluation of new alternatives; (c) new equipment for manufacturing non-PFOS based firefighting foam; (d) site preparation for installing new equipment; (e) tanks and storage facilities; (f) testing efficacy of new products; and (g) registration of new surfactants and firefighting foam. In addition, financing costs of new non-PFOS firefighting foam needed for training at 3 training facilities of the public security ministry could be supported, as well as costs of firefighting equipment retrofit or procurement of new equipment, together with facilities for facilities treatment of wastewater discharge.

*Pest control:* The project will finance procurement of pesticides (9 tons total: 6 tons of indoxacarb based baits, 3 tons of cypermethrin based powder, and a small amount of hydramethylnon) for demonstration of a two-phase treatment method using bait and powder to control red fire ants, carried out under component 3.

*Disposal of PFOS containing waste:* Identification of waste producing units and classification of hazardous wastes; Select units with hazardous waste disposal qualification to carry out the collection, transportation and disposal of PFOS containing hazardous waste.

### **Component 3: Policy and Technical Assistance**

This component is carried out in Hubei, Fujian, Guangdong, Guangxi, Guizhou and Hainan Province and will finance technical assistance activities required to strengthen regulatory and policy framework, standards, and capacity building. These activities are essential for ensuring sustainability of PFOS phase-out in both production and consumption sectors. TA activities include:

*Standards and Regulations:* The Project will carry out activities to develop industry standards, good practices, and regulations to support introduction of non-PFOS alternatives. Supported activities would include: (a) labeling scheme to ensure that commercially available chromium mist suppressant will have to be properly labeled; (b) development of technical specifications for chromium mist suppressants, including efficacy in protecting human health and safety; (c) standards defining PFOS waste, and related best practices for disposal; specification of discharge of wastewater containing PFOS for electroplating industry in Guangdong province; (d) development of guidelines for cleaner production for organofluorine manufacturing industry; (e) revision of cleaner production audit indicator system for electroplating industry to include PFOS in Guangdong Province; (f) technical report on efficacy of non-PFOS based pesticides for controlling red imported fire ant; and (g) development of guidelines for green procurement for the oil sector.

*Screening of non-PFOS Alternatives:* To ascertain that new non-PFOS alternatives to be introduced in China should not have PBT characteristics, a PBT screening system for new chemicals will be established. Supported activities include: (a) guidelines for registration of new chemicals including reporting requirement on PBT characteristics; (b) development of standard testing protocol for determining PBT characteristic of organofluorine chemicals; and (c) screening reports on PBT characteristics of at least 10 non-PFOS chromium mist suppressants; (d) technical evaluation of waste disposal with PFOS (newly added).

*Technical Studies:* A series of studies will be carried out under the project to enhance understanding of import/export control of PFOS, and of PFOS use as CMS in electroplating factories in Guangdong province. To guide the chrome plating industry in the future as part of the efforts to sustain achievement of this project, the Project will finance the testing of mist suppression performance of alternatives and develop a list of acceptable chromium mist suppressants. A preliminary study will also be conducted on health impacts of PFOS in China as a first step to scoping and better understanding the issue.

*Technical Assistance to Eliminate the Use of PFOS in Firefighting:* The project will support testing the safety and efficacy of alternative non-PFOS firefighting foams and products; devising technical way forward for substitution of PFOS in the firefighting sector; revising relevant standards as needed;

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capacity development to detect PFOS substances in foam extinguishing agents; and strengthening the tracking and control of PFOS containing firefighting agents. Since a large quantity of PFOS firefighting foam is used for training, adopting new non-PFOS alternative foam could lead to permanent reduction of a significant quantity of PFOS. The project would therefore finance revision of firefighting protocols and training manuals for effective use of new non-PFOS firefighting foam without compromising safety and health of firefighting cadets. Conduct research and formulation of a series of fire industry policies and standards (newly added).

*Technical Assistance to Eliminate the Use of PFOS for control of RIFA:* Demonstration of alternative pest management techniques and practices will be conducted for four years in 5 provinces, Fujian, Guangdong, Guangxi, Guizhou and Hainan. The project will cover costs related to the ‘training of trainers’ program that will involve ‘training schools’ in the 5 demonstration provinces and up to additional 5 provinces. Participants will include county, municipal and provincial level practitioners.

*PFOS Registration and Reporting System:* The project will strengthen capacity of Ministry of Environment Protection (MEP) and local Environmental Protection Bureaus (EPBs) to enforce regulations and monitoring requirements for hazardous substances. A tracking system will be developed to support registration of producers of PFOSF, secondary PFOS based product manufacturers, and users of PFOS products in firefighting foam industry. The system will assist China to monitor production and supply of PFOS materials from sources to end users. Technical capacity of local EPBs will be strengthened to enable them to carry out or supervise factory audits to prevent any diversion of PFOSF to banned applications. Efforts would mainly focus on strengthening capacity of local EPBs in Fujian and Hubei to control the PFOS supply chain.

#### **Component 4: Project management**

Component 4 will finance: (i) costs of operations of three project management offices (PMOs) at FECO, Guangdong EPB and Hubei EPB, as well as (ii) Monitoring and Evaluation. Eligible costs include expenditures incurred by the PMOs in carrying out the Project.

##### **1.1. Purpose of this SMF**

The purpose of formulating or updating the social management framework is mainly in two aspects: ① the project content involves the reduction and replacement of the original PFOS production industry and application industry, as well as the formulation of PFOS policies and regulations. In the process of project implementation, after each subproject is determined, it may involve social risks such as land acquisition and demolition, laid-off of employees of the original enterprise and so on. Therefore, the social management policy framework of this project needs to be prepared. ② The newly added activities such as waste disposal and formulation of policies and regulations in the process of restructuring, such as land acquisition and demolition, laid-off of enterprise staff and other social risks, should be implemented in accordance with this social management framework.

The preliminary identification of the social impact of the project shows that most of the project activities are carried out on the existing enterprise sites, and do not involve land acquisition, demolition and labor layoff. If there is, the scale is very small, which is generally applicable to op4.01.

Some production lines may close or relocate enterprises. If this may need the WB’s involuntary resettlement policy op4.12, a resettlement compensation plan should be prepared

Since most of the activities of the project are within the scope of cities or suburbs and do not involve the ethnic minorities living in compact communities, this social management policy framework does not include the ethnic minority policy framework.

The newly added activities in the process of restructuring do not involve enterprise demonstration, transformation and upgrading. All activities are carried out within the conventional business scope of existing enterprises, and the preliminary analysis has positive economic benefits for enterprise operation. It is preliminarily judged that there are no land acquisition and relocation, labor layoffs and other situations due to the implementation of the project, and the newly added activities in the process of restructuring do not involve ethnic minorities. Therefore, after preliminary social risk screening, the new activities in the restructuring process do not trigger op4.10 and op4.12. The occupational health and safety risk of workers involved in hazardous waste disposal may be involved in the new activities

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of project reorganization, which has been concerned in the corresponding Environmental and Social impact assessment and Environmental and Social management plan. After the restructuring of the project, if there are social risks such as land acquisition, demolition and staff layoff, the social management framework shall be implemented.

The purpose of the social management framework is to ensure that all means are taken to avoid or minimize the social impact in all activities; In terms of those unavoidable impacts, necessary reduction measures will be identified, formulated and implemented in accordance with relevant World Bank policies and Chinese laws.

The social management policy framework establishes the objectives, procedures, institutional framework and implementation arrangements for identifying and managing the potential social impacts of project activities. At the same time, the mechanism of public participation and settlement of possible public complaints has been established.

The social management policy framework includes three tools: 1) the procedure of social impact identification and approval; 2) The resettlement policy framework is applicable to the projects involving land acquisition and demolition; 3) Social evaluation and labor placement policy framework are applicable to projects with major social impacts, especially those with laid-off labor.

### **1.2. Implementation of the original Social Management Framework**

Since the implementation of the project, all the PMOs have carried out the social safeguard management according to the requirements of this Social Management Framework, and conducted relevant training and public participation and other work in an orderly way, so as to ensure that the social impacts in the implementation process of the project activities are solved effectively and properly. The grievance mechanism of the entire project has been upgraded, which has been disclosed at the public website of the stakeholders, to receive and solve the issues raised by those who are affected. By May 31, 2021, no complaints have been received.

Among the activities that have been executed, social impact identification has been conducted concerning all the sub-projects that might have social safeguard risks. The existing potential risks identified are all concentrated in the activities of the pilot enterprises and the construction of the demonstration zones.

Pertaining to the implementation of the demonstration enterprises' activities, efforts of identification have mainly focused on the potential social impacts of the sub-projects that have been suspended in Hubei Youshida Science and Technology Co., Ltd. and Hubei Hengxin Chemical Co., Ltd. Since the former workers have been transformed to new enterprises after the suspension, there are no actual laid-off workers. Therefore, the enterprises have developed the simplified "Compensation Scheme for the Arrangement of Workers", committing and acknowledging to arrange all the workers in the new posts after the suspension of the PFOS. Concerning the sub-projects with identified social risks, mitigation and management measures (action plans) have been developed according to the requirements of this framework, which has been executed according to the plan. The project has completed the development of the social safeguard document – the "Resettlement Action Plan of the Production Conversion Sub-Project of Hubei Hengxin Chemical Co., Ltd.", among which the "Resettlement Action Plan of the Production Conversion Sub-Project of Hubei Hengxin Chemical Co., Ltd." has completed its execution.

### **1.3. Safeguard measures in the context of force majeure**

The implementation of the project will be affected by all kinds of force majeure, especially at this stage of COVID-19. The epidemic situation may affect the implementation progress of the project. The preliminary identification has no significant environmental impact on the activities under the project, but it may cause some social security problems, such as ① the laid-off of employees, ② the reduction of wages, ③ personal health and safety risks, etc.

The social risks caused by force majeure in the process of project implementation can be handled according to this Social Management Framework. In case there are any social risks not covered by this Social Management Framework, they can be handled according to the relevant policies and stipulations of the World Bank, as well as national and local governments.

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In particular, due to the uncertain and long-term spreading and development of COVID-19, arrangement and compensation plans shall be developed and executed according to the requirements of this Social Management Framework to solve the possible issues such as the laid-off workers.

In the meantime, the project implementation units and stakeholders shall take all reasonable measures to safeguard the health, safety and other legal rights according to the relevant requirements on occupational health and safety in the World Bank's General EHS Guidelines, the national and local laws, regulations and policies, as well as the specific management regulations and measures released by the national and local governments related to the COVID-19. The project will prefer those contractors (project implementation units) that are capable to manage the occupation health and safety of their employees, and ensure that the contractors will implement the hazard management rules through formal procurement agreements. In specific, it is recommended that the following preventive and protective measures shall be taken according to the following priorities:

- ☒ Eliminate dangers: to eliminate the dangerous activities from the work procedures.
- ☒ Control dangers: to take engineering control measures to control the sources of dangers. For example, to deploy exhaust ventilation equipment in certain areas, separation chamber, machine protection, and so on.
- ☒ Reduce risks: to design safety work system and administrative and institutional control measures. For example, to take rotation work mechanism, conduct training on safety work procedures, carry out locking/labeling safety system, monitor the worksites, and limit the exposure levels and work time, and so on.
- ☒ Provide proper personal protection equipment (PPE): to conduct training on the personal protection equipment, request the employees to use the PPE and carry out maintenance on the PPE.

## **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 foam production sectors;
- Step 2—screening potential social safeguards and impacts (including labor unemployment and land acquisition and resettlement) during implementation according to the applicable PRC regulations and Bank policies, and determining required social safeguard documents. Social assessment will be carried out for every subproject. For those subprojects, which have no adverse social impacts on land acquisition and resettlement, no presence of indigenous peoples, no job loss for employees, a social screening will be performed. Otherwise, a comprehensive social assessment shall be done and a SA report submitted to the World Bank task team via relevant PMOs.
- Step 3—preparing terms of reference (TORs) for the social safeguard consultants, and the Social Assessment (SA) Report and the Resettlement Action Plan (RAP) and or Employee Resettlement Plan(ERP) for the affected enterprises;
- Step 4—review of the TORs for the SA Report and/or RAP and or ERP 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 other social management plan such as employee resettlement plan if any; 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

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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); and 2) 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 safeguards documents. 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 abbreviated RAP (ARAP) should be prepared.
- **ERP:** In any case of employee redundancy with labor contract termination from the pilot enterprise, an employee resettlement plan should be prepared in consultation with professional expert and submitted to the Bank via FECO for prior review and agreement. Local Chinese labor laws and regulations and World Bank safeguards policies should be followed to ensure appropriate compensation and livelihood restoration for affected people. Those laying off less than 20 employees, the employee resettlement plan can be covered in the environment assessment and ESMP under OP 4.01. The employee resettlement plan will be monitored and evaluated during the project implementation period. through hiring experienced professionals.
- **SA:** A social screening will be done for every subproject to assess social impacts and risks. If any major social impact is expected to arise, such as closing down PFOS manufacturing or using enterprises to cause worker unemployment, a comprehensive 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 (male and female). 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.

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The TORs of the RAP and the SA report and ERP 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 they are not properly treated under the Project, a grievance redress mechanism is necessary and should include: 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 activity 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.

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## ***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 team 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 activity 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 which may include an Employee 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.

- If a RAP is required, then each RAP to be prepared 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 affected people (APs) are entitled to restoration measures to

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- 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 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

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- 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 safeguards (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

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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: (1)increase cultivated area if land is available; (2)improve agriculture through irrigation, etc.; and (3)develop nonagricultural income. Like fixed assets, affected young crops, fruit and commercial forests will be compensated 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 safeguards 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.

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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. Framework for SA/Employee 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/Employee 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 an employee resettlement plan (ERP) 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 ERP or include a chapter on workers' resettlement in the SA report. The ERP 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 ERP;
- A procedure for addressing appeals from affected workers arising from project implementation;
- Institutional arrangements; and time schedule;
- 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 ERP should be disclosed on local newspapers and government websites before implementation.

Considering that there are some gaps between the domestic resettlement policy and the Bank's OP4.12, during the resettlement implementation stage of projects covered by this RPF, PMO will adopt good practices and policy from the Bank on the basis of domestic laws. Below is a description of policy gaps between PRC and the World Bank, and guidance on which policies to be implemented. See table 4-1.

**Table 4-1 Gaps between China and the World Bank's policy and Measures in This Project**

	<b>Policy of China</b>	<b>Policy of the World Bank</b>	<b>Policy to be followed</b>
Goal	Avoid or minimize involuntary resettlement as far as possible; ensure living standard of project affected persons is not lower than before.	Avoid or minimize involuntary resettlement as far as possible; ensure living standard of project affected persons is not lower than before.	Consistent
Resettlement approach	Land acquisition is generally compensated by currency, supplemented by employment assistance and social safeguards. The following resettlement approaches are available to the households affected by the demolition of rural residential houses: 1. Cash compensation; 2. Housing land + self-built houses. The project owner will offer housing land for relocation and conduct land leveling and constructing infrastructure for AHs. 3. Resettlement housing. When resettlement house is chosen as compensation mode, the location and type of resettlement house have been determined.	Affected people have their own right to choose mode of livelihood restoration	Carry out the Bank's policy
Calculation method of compensation fees	Take the market price of house that of the same type and purpose at the same district as the compensated price.	The price shall be calculated based on estimated replacement cost, without considering depreciation.	Replacement housing should be used if chosen by APs. Full market price for new houses should be used if cash compensation is selected by APs. Total compensation will include market price plus all transaction cost to match replacement cost.
compensation for illegal building	No compensation shall be provided for illegal buildings.	Compensation is provided for illegal buildings.	Those occupied affected houses before cut-off date are entitled to full compensation.
Public participation	Public participation system is not sound enough, public can only participate in some phases of the project implementation.	A complete and sound public participation process should be followed, during the full process of impact assessment and determination of compensation mode, and implementation of LA and resettlement.	Wide public consultation should be ensured for APs to participate in impact assessment, alternatives identification, and implementation of resettlement work.
Monitoring arrangement	Internal management mechanism of project owner and resettlement implementation agency conducts the monitoring process.	Including internal monitoring from the internal management mechanism of project owner and resettlement implementation agency and external monitoring	Set up external and internal monitoring systems as required by the Bank.

	Policy of China	Policy of the World Bank	Policy to be followed
		from the external independent monitoring unit.	
Grievance mechanism	Set up specialized agency to accept public grievance.	Public can appeal through multiple channels and ways, including community, sub-district, project owner, external monitoring agency, etc.	Set up grievance mechanism as required by the Bank.

Before the determination of a subproject's eligibility for Bank funding in this project, the PMO should submit a social screening result report, which could include a specific project enterprise-based employee resettlement plan (ERP) draft to the Bank for review 3 months before implementation. Such subproject can only be implemented after review and approval. The approved ERP 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

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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).

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**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 from 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).

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#### **4.4. Implementation Process**

The ERP 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 female workers), and approved by the competent authorities, PMOs and Bank. At the implementation stage, the PMOs will be responsible for ERP 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 resettlement measures**

Special attention is given to the unemployment risk of workers of the project enterprises which would be relocated or closed down fully or partially. Each selected pilot enterprise needs to conduct public consultation on employee resettlement with workers, and address their concerns by closely following related labor regulations and laws and the affected employees' contracts signed with the project enterprise.

- i) All workers will be provided equal opportunity with no discrimination, especially those vulnerable employees such as pregnant women, the disabled and the old staff, and those reemployed by former enterprises or employed by new enterprises after product changeover;
- ii) Their wages will be in line with the value of similar jobs in the labor market after reemployment;
- iii) Their previous lengths of service will remain unchanged, and social benefits are observed according to relevant government regulations;
- iv) Pre-job training will be offered; and
- v) Workers who are unwilling to be reemployed or work at new location of the enterprises may go through resignation formalities and ending labor contracts according to the Labor Law and their labor contract signed with the enterprise.

In case of worker redundancy with labor contract termination from the enterprise, an employee resettlement plan should be prepared by professional expert and submitted to the Bank via FECO for prior review and agreement. The employee resettlement plan will be monitored and evaluated during the project implementation period.

#### **4.6. Review / approval of employee resettlement plan**

The resettlement plan must comply with the statutory procedures applied in China. a) if the employer needs to lay off more than twenty employees, firstly, all employee should be consulted and all relevant information is made available. And the staff retrenchment plan must be submitted to the Staff Congress and trade union or staff association if any. Employees' opinions should be reflected in the employee resettlement plan and fully implemented. The employee resettlement plan needs to be submitted to the local human resources and social safeguards department for review and confirmation as required by the government labor policies; b) if the employer needs to lay off any employee regardless of total numbers of less or more than 20 staff, it should give at least thirty days' notice in advance, also notify the trade union or staff association to explain the situation, reasons and measures to addressing the affected employee's rights and interest, All the sub project resettlement plan should be reported to the local the project management office; c) all employee resettlement plan should be submitted to FECO and the World Bank for prior review.

#### **4.7. Financial Arrangements**

Funds needed for the implementation of the ERP will be from company, and government cover costs for employees' reemployment assistance through providing short-term free skill training or subsidizing training for laid-off workers.

### **5. Organizational Structure and Capacity Building**

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 safeguards 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, Employee resettlement plan and or RAP; 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 which could include an employee resettlement plan ERP or RAP as and when required. 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 social assessment and implement RAPs or ERPs as required with the assistance of the consultants.

In particular, for the newly added activities in the restructuring, the project will carry out special training on environmental and social safeguards requirements for relevant implementation units and PMOs, and guide and supervise relevant units to implement social safeguards requirements in accordance with the requirements of this framework.

At the same time, the project will carry out training for force majeure, especially for the relevant epidemic prevention requirements of all implementation units under the framework of covid-19 epidemic situation, so as to ensure that the participating units will take all measures to implement the requirements of the framework and effectively protect the health, safety and legitimate rights and interests of employees.

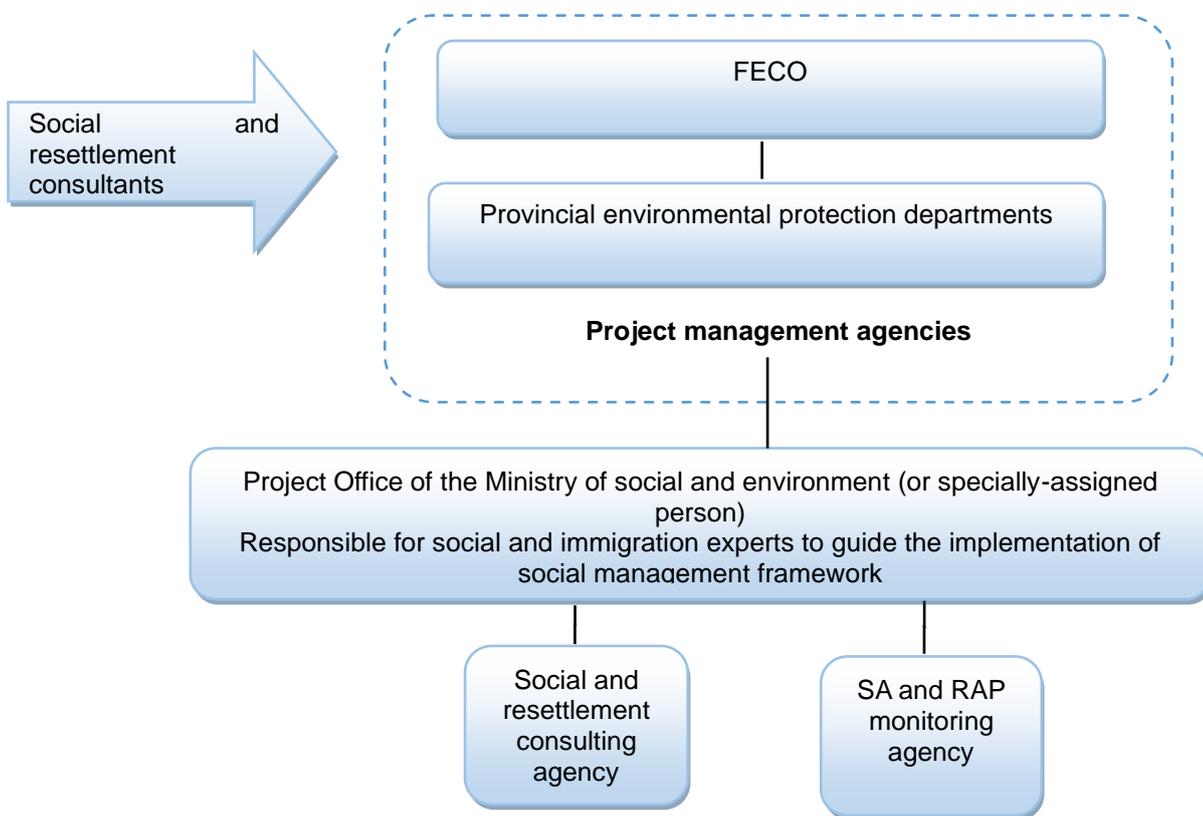


Figure 5-1 Organizational Chart for Social and Resettlement Management of the Project

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## 6. Public Participation and Grievance Redress

### 6.1. Public Participation and Information Disclosure

The RAP and the ERP/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 ERP/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 ESMF was disclosed in the affected cities and enterprises for comment.

The disclosure of the original social management framework of the project is shown in 5.3 information disclosure and public participation of the Environmental and Social Management Framework. In particular, the stakeholders of the project disclosed two rounds of social safeguards documents, i.e. the resettlement action plan of Hubei Hengxin Chemical Co., Ltd. and the staff reduction and resettlement plan of Xiaochang Xiangshun Chemical Co., Ltd.

### 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 ERP, 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 ERP 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	Unkn own	Description	If yes, Bank policy triggered	If yes, document required
<b>I. Resettlement and LA</b>							
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

	Item	Yes	No	Unkn own	Description	If yes, Bank policy triggered	If yes, document required
<b>II. Workers</b>							
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.

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## Appendix 2: Outline 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 Policies
  - 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

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- 6.6 Restoration program for ground attachments
  - 7 Organizational Structure and Implementation Progress
    - 7.1 Organizational structure
      - 7.1.1 Organizational setup
      - 7.1.2 Organizational responsibilities
      - 7.1.3 Staffing
      - 7.1.4 Equipment
      - 7.1.5 Training program
    - 7.2 Implementation progress
  - 8 Budget and Funding Sources
    - 8.1 Budget
    - 8.2 Annual investment plan
    - 8.3 Funding sources and disbursement
  - 9 Public Participation and Grievance Redress
    - 9.1 Started public participation and consultation activities
    - 9.2 Information disclosure
    - 9.3 Participation and willingness survey
    - 9.4 Public participation and feedback
    - 9.5 Subsequent information disclosure and public participation plan
  - 10 M&E
    - 10.1 Internal monitoring
      - 10.1.1 Implementation procedure
      - 10.1.2 Scope
      - 10.1.3 Reporting
    - 10.2 External M&E
      - 10.2.1 External M&E agency
      - 10.2.2 Procedure and scope
      - 10.2.3 M&E indicators
      - 10.2.4 Reporting
      - 10.2.5 Post-evaluation
  - 11 Entitlement Matrix
- Appendixes

## 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
Province	1	Fujian	Interim Regulations on Farmland Occupation Tax of the PRC	2008-1-1
			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
	2	Hubei	Notice of the Fujian Provincial Government on Adjusting Land Acquisition Compensation Rates (FPG [2012] No.57)	2012-12-7
			Measures of Hubei Province for the Implementation of the Land Administration Law of the PRC	2010-7-30
			Notice of the Hubei 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 Hubei 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

Level	No.	Location	Document	Effective date
			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
	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.
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.	

Type	Aps	Measure	Entitlement
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) They 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 Employee Resettlement Plan

Type	Policy/regulations	Contents and key points
Employees' 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 Safeguards 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 Employees of Enterprises	<ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>3) Where the labor contract is dissolved according to law, the employer shall pay economic compensation to the laborer. 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.</li> <li>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.</li> <li>5) Employment and social safeguards 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.</li> <li>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.</li> <li>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.</li> <li>8) If an enterprise is to reduce its workforce according to law, it</li> </ol>

Type	Policy/regulations	Contents and key points
	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	<p>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 from 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)</p> <p>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)</p> <p>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 engage 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)</p> <p>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)</p>
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 the New Situation (HPG [2015] No.46)	<p>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.</p> <p>2) Rewards for eliminating backward production facilities, and land compensation paid to enterprises under merger and reorganization policies shall be first used for employee resettlement. A sound unemployment monitoring and early warning mechanism shall be established to respond to unemployment risks.</p> <p>3) Employment assistance for residents with difficulty: The scope of residents with difficulty in employment shall be 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.</p>

Type	Policy/regulations	Contents and key points
		<p>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.</p> <p>5) A mechanism of coordination between employment and social safeguards 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.</p>