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Report No: PAD388

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED GRANT FROM THE
GLOBAL ENVIRONMENT FACILITY TRUST FUND

IN THE AMOUNT OF
US$12.0 MILLION

TO THE

PEOPLE'S REPUBLIC OF CHINA

FOR A

MUNICIPAL SOLID WASTE MANAGEMENT PROJECT

October 21, 2014

Environmental and Natural Resources Global Practice
China and Mongolia Country Unit
East Asia and Pacific Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective September 15, 2014)

Currency Unit = CNY
CNY 6.14 = US$1

FISCAL YEAR

January 1 – December 31

ABBREVIATIONS AND ACRONYMS

ASME	American Society of Mechanical Engineers
BAT	Best available technique
BEP	Best environmental practice
CEM	Continuous emission monitoring
CNAO	China National Audit Office
CPS	Country Partnership Strategy
DA	Designated account
EA	Environmental audit
EHS	Environmental, health and safety
EIA	Environmental impact assessment
EMP	Environmental management plan
EPB	Environmental protection bureau
FECO	Foreign Economic Cooperation Office
FM	Financial management
FY	Fiscal year
FYP	Five year plan
GEF	Global Environment Facility
IA	Implementing Agency
IBRD	International Bank for Reconstruction and Development
ICB	International competitive bidding
IT	Information technology
KWH	Kilowatt hour
LED	Light-emitting diode
MEP	Ministry of Environmental Protection
MOF	Ministry of Finance
MOHURD	Ministry of Housing Urban and Rural Development
MSW	Municipal solid waste
MT	Million tons
M&E	Monitoring and Evaluation
NCB	National Competitive Bidding
NIP	National implementation plan
NMFB	Ningbo Municipal Finance Bureau
OP	Operational policy
ORAF	Operational risk assessment framework
PAD	Project appraisal document
PDO	Project development objective
PMO	Project management office
POPs	Persistent organic pollutants
QA&QC	Quality assurance and quality control
QBS	Quality-Based Selection
QCBS	Quality- and Cost- Based Selection
SC	Stockholm Convention
TEQ	Toxic equivalent
UMB	Urban management bureau
USD	United States Dollar
YEPD	Yunnan Environmental Protection Department
YPFB	Yunnan Provincial Finance Bureau

Regional Vice President:	Axel van Trotsenburg, EAPVP
Country Director:	Bert Hofman, EACCF
Sector Director:	John Roome, GPSOS (through June 30, 2014)
Global Practice Senior Director:	Paula Caballero, GENDR (from July 1, 2014)
Global Practice Director:	Bilal Rahill, GENDR (from July 1, 2014)
Practice Manager:	Iain G. Shuker, GENDR(from July 1, 2014)
Task Team Leader:	Tijen Arin, GENDR

CHINA
Municipal Solid Waste Management Project

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PAD DATA SHEET

China

CH GEF Municipal Solid Waste Management Project (P126832)

PROJECT APPRAISAL DOCUMENT

EAST ASIA AND PACIFIC

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Basic Information			
Project ID	EA Category		Team Leader
P126832	A - Full Assessment		Tijen Arin
Lending Instrument	Fragile and/or Capacity Constraints [ ]		
Investment Project Financing	Financial Intermediaries [ ]		
	Series of Projects [ ]		
Project Implementation Start Date	Project Implementation End Date		
11-Sep-2014	31-Dec-2019		
Expected Effectiveness Date	Expected Closing Date		
05-Jan-2015	31-Dec-2019		
Joint IFC			GEF Focal Area
No			Persistent Organic Pollutants
Practice Manager/Manager	Senior Global Practice Director	Country Director	Regional Vice President
Iain G. Shuker	Paula Caballero	Bert Hofman	Axel van Trotsenburg

Borrower: People's Republic of China			
Responsible Agency: Foreign Economic Cooperation Office of Ministry of Environmental Protection			
Contact:	Ms. Qiong Ding	Title:	Division Chief
Telephone No.:	86108226-8810	Email:	ding.qiong@mepfeco.org.cn

Project Financing Data(in USD Million)					
[ ]	Loan	[ ]	IDA Grant	[ ]	Guarantee
[ ]	Credit	[X]	Grant	[ ]	Other

Total Project Cost:	32.91	Total Bank Financing:	0.00
Financing Gap:	0.00		

Financing Source	Amount
Borrower	20.91
Global Environment Facility (GEF)	12.00
Total	32.91

Expected Disbursements (in USD Million)

Fiscal Year	2015	2016	2017	2018	2019	2020	0000	0000	0000	0000
Annual	0.34	0.70	2.50	4.00	3.65	0.81	0.00	0.00	0.00	0.00
Cumulative	0.34	1.04	3.54	7.54	11.19	12.00	0.00	0.00	0.00	0.00

Institutional Data

Practice Area / Cross Cutting Solution Area

Environment & Natural Resources

Cross Cutting Areas

[ ] Climate Change
[ ] Fragile, Conflict & Violence
[ ] Gender
[ ] Jobs
[ ] Public Private Partnership

Sectors / Climate Change

Sector (Maximum 5 and total % must equal 100)

Major Sector	Sector	%	Adaptation Co-benefits %	Mitigation Co-benefits %
Water, sanitation and flood protection	Solid waste management	100		
Total		100		

☑ I certify that there is no Adaptation and Mitigation Climate Change Co-benefits information applicable to this project.

Themes

Theme (Maximum 5 and total % must equal 100)

Major theme	Theme	%
Environment and natural resources management	Pollution management and environmental health	50
Environment and natural resources management	Environmental policies and institutions	50
Total		100

Proposed Global Environmental Objective(s)

The project objective is to build capacity and demonstrate best available techniques (BAT) and best environmental practices in municipal solid waste incineration in accordance with the Stockholm Convention.

Components	
Component Name	**Cost (USD Millions)**
Capacity Building for Improved Operation and Regulation of MSW Incinerators	27.44
Capacity Building for Improved MSW Management Planning	1.75
Project Management	3.72

Compliance

Policy

Does the project depart from the CAS in content or in other significant respects?	Yes [ ]	No [X]
Does the project require any waivers of Bank policies?	Yes [ ]	No [X]
Have these been approved by Bank management?	Yes [ ]	No [ ]
Is approval for any policy waiver sought from the Board?	Yes [ ]	No [X]
Does the project meet the Regional criteria for readiness for implementation?	Yes [X]	No [ ]

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment OP/BP 4.01	**X**	
Natural Habitats OP/BP 4.04		**X**
Forests OP/BP 4.36		**X**
Pest Management OP 4.09		**X**
Physical Cultural Resources OP/BP 4.11		**X**
Indigenous Peoples OP/BP 4.10		**X**
Involuntary Resettlement OP/BP 4.12		**X**
Safety of Dams OP/BP 4.37		**X**
Projects on International Waterways OP/BP 7.50		**X**
Projects in Disputed Areas OP/BP 7.60		**X**

Legal Covenants

Name	Recurrent	Due Date	Frequency
Institutional Arrangements	**X**		Continuous

Description of Covenant

FECO PMO, the Yunnan PMO and the Ningbo PMO shall be maintained with terms of reference (TOR), staffing and other resources satisfactory to the Bank. (Section I. A. 1 of Schedule 2 to the Grant Agreement)

Name	Recurrent	Due Date	Frequency
Institutional Arrangements		06-Feb-2015	

Description of Covenant

Establishment of the Yunnan Project Leadership Group. (Section I. A. 2 of Schedule 2 to the Grant Agreement)

Name	Recurrent	Due Date	Frequency
Safeguards	X		Continuous

Description of Covenant

(i) The project is to be carried out in accordance with the Environmental Management Plans; (ii) the establishment of a grievance redress mechanism; and (iii) the TORs for any consultancies related to studies, assessments and technical assistance activities under the Project shall be satisfactory to the World Bank. (Section I. D. of Schedule 2 to the Grant Agreement)

Name	Recurrent	Due Date	Frequency
Annual Work Plans	X		Yearly

Description of Covenant

Submission of a consolidated annual work plan by no later than March 1st of each year to the World Bank. (Section I. E. of Schedule 2 to the Grant Agreement)

Name	Recurrent	Due Date	Frequency
Operational Improvements in Demonstration Incinerators	X		Continuous

Description of Covenant

(i) The appraisal of the Demonstration Incinerators, including their compliance with certain eligibility criteria following the first year audits; and (ii) the provision of contributions to each Demonstration Incinerator under an operational improvement agreement. (Section I. F of Schedule 2 to the Grant Agreement)

Name	Recurrent	Due Date	Frequency
Financial Viability Plan of Participating Incinerators	X		Yearly

Description of Covenant

(i) The preparation of a financial viability plan for each Participating Incinerator (3 months after the completion of the operational and environmental audit for the respective Participating Incinerator); and (ii) the submission of a progress report on the implementation of each plan (unless the Participating Incinerator is not selected as a Demonstration Incinerator). (Section I. G of Schedule 2 to the Grant Agreement)

Name	Recurrent	Due Date	Frequency
Environmental and Operational Performance of Participating Incinerators	X		Yearly

Description of Covenant

Yunnan monitors and reports on: (i) the environmental performance of the Participating Incinerators; (ii) the actions taken by the Participating Incinerators to comply with the findings of the respective environmental and performance audits; and (iii) the implementation of the operational improvement program designed for each Participating Incinerator. (Section I. H. of Schedule 2 to the Grant Agreement)

Conditions

Source Of Fund	Name	Type

GEFU	Signing of implementation agreements	Effectiveness

Description of Condition

Signing of the implementation agreements between the Ministry of Environmental Protection and Yunnan Province and Ningbo Municipality, respectively. (Article V 5.02. to the Grant Agreement)

Team Composition

Bank Staff

Name	Title	Specialization	Unit
Lourdes L. Anducta	Program Assistant	Program Assistant	GSURR
Tijen Arin	Senior Environmental Economist	Team Lead	GENDR
Xieli Bai	Program Assistant	Program Assistant	EACCF
Sing Cho	Urban Specialist	Urban Specialist	GWADR
Ashraf Bakry El-Arini	Junior Professional Associate	Junior Professional Associate	GENDR
Laurent Granier	Senior Environmental Specialist	Senior Environmental Specialist	GCCIA
Daniel A. Hoornweg	Consultant	Lead Urban Specialist	GEFVP
Nina Queen Irving	Senior Program Assistant	Senior Program Assistant	GENDR
Minneh Mary Kane	Lead Counsel	Lead Counsel	LEGES
Minhnguyet Le Khorami	Program Assistant	Program Assistant	GFADR
Zheng Liu	Procurement Specialist	Procurement Specialist	GGODR
Aristeidis I. Panou	Counsel	Legal Counsel	LEGOP
Chaogang Wang	Senior Social Development Specialist	Senior Social Development Specialist	GSURR
Ning Yang	Environmental Specialist	Environmental Safeguards and Co-Team Lead	GENDR
Fang Zhang	Financial Management Specialist	Financial Management Specialist	GGODR

Non Bank Staff

Name	Title	City
Hardy Wong	Waste Management Specialist	Toronto

Locations

Country	First Administrative Division	Location	Planned	Actual	Comments
People’s Republic of China	Yunnan	Kunming		X	
People’s Republic of China	Zhejiang Sheng	Ningbo		X	

I. STRATEGIC CONTEXT

A. Country Context

1. The rapid increase of production and consumption in China since 1978 has brought about significant environmental pollution and ecological degradation. The Chinese Government is committed to reversing this negative trend and has made environmental protection a national priority. As part of this commitment, China has ratified numerous international conventions including the Stockholm Convention on Persistent Organic Pollutants (POPs) in 2004 for which a National Implementation Program (NIP) was prepared in 2007. POPs are a group of chemical substances that persist in the environment, can be transported far from their sources and bio-accumulated through the food web, and can "lead to serious health effects including certain cancers, birth defects, dysfunctional immune and reproductive systems, greater susceptibility to disease and even diminished intelligence"[1]. Under the Stockholm Convention, a total of 21 chemical substances are listed as POPs, including pesticides (such as DDT), industrial chemicals (such as polychlorinated biphenyls, PCBs) and unintentional by-products of industrial processes, such as dioxins and furans[2]. According to the NIP, municipal solid waste (MSW) incineration is one of the key sources of dioxin and furan release in China.

B. Sectoral and Institutional Context

2. MSW management is a growing concern for China's cities. With China's rapid economic development, urbanization, and rising standards of living, the quantity of MSW collected and transported has increased more than five-fold nationwide from about 85 thousand tons per day in 1980 to about 430 thousand tons per day in 2009 and is projected to reach 1.6 million tons per day in 2030. No country has ever experienced as large and rapid an increase in waste generation.

3. Modern MSW management, which, in order of preference, favours minimization (reduction), reuse, recycling, and recovery (digestion and composting), is gaining ground in China. To reduce waste and increase recycling, the Chinese Government has formulated a number of important laws and development plans including sections in the Five Year Plans, the 'Solid Waste Pollution Prevention and Control Law' (2005), and the 'Circular Economy Promotion Law' (2009). The 12th Five Year Plan (FYP) envisages that by 2015 all counties will be able to adequately manage solid wastes. The Plan emphasizes recycling and aims to demonstrate in 80 cities proper recycling of post-consumer materials, including through rational integrated recycling systems, effective management, and a variety of recycling approaches and technologies to achieve a higher rate of recovery. Recently, the State Council published a "public announcement on kitchen waste management", which focuses on separate collection and treatment of restaurant waste and requires that 33 cities implement plans to this end.

4. An increasing number of cities are preparing and implementing plans for source segregation and recycling. One such city is Ningbo which is implementing a United States Dollar

[1] Stockholm Convention on POPs. See http://chm.pops.int/Convention/tabid/54/language/en-US/Default.aspx.

[2] Dioxins and furans are short forms for polychlorinated dibenzo-p-dioxins and polychlorinated dibenzo furans (PCDDs and PCDFs) which are a group of chemically similar compounds. In this document, unless otherwise specified, the word "dioxins" is used to stand for both dioxins and furans.

(USD) 246 million segregation and recycling project supported by a USD 80 million World Bank loan. The project addresses the large organic content of Chinese MSW, which along with other materials, such as plastic bags and packaging materials that are not recycled by informal waste pickers, is transported to disposal facilities. One key constraint to the development of MSW segregation and recycling plans is the lack of statistical data on waste generated in a municipality. Data compiled in the Urban and Rural Construction Statistical Yearbook represents only the amount of waste that is collected and transported for treatment or disposal, excluding waste that is recycled by informal recycling or disposal routes. The latter is said to make up 20 percent – 30 percent of the total waste stream. Without a complete and thorough understanding of the amount and types of MSW being generated by households and industrial, commercial and institutional entities, it is impossible to plan effective waste segregation and recycling programs, or appropriate treatment and disposal facilities.

5. At the same time, incineration is becoming more and more the disposal method of choice in urban areas motivated by a shortage of urban land for landfills and the national policy encouraging energy generation from waste ("waste-to-energy"). A series of incentive policies are in place to encourage investment in MSW incinerators, including value added tax refunding, prioritized commercial bank loans, state subsidy (2%) for loan interest, and favourable feed-in tariff for the electricity sale into the grid.[3] The April 2011 State Council-endorsed a formal document entitled "Suggestions for Further Strengthening MSW Management", which was jointly prepared by 16 ministries requires that in cities that lack land priority should be given to incineration. Consequently, the number of MSW incinerators in China is projected to increase from 93 in 2009 to 200 in 2015, with a corresponding increase in daily disposal capacity from 55.4 thousand tons to 140 thousand tons.

6. Plans for MSW management, including disposal through incineration, are generally made within municipal or, at times, district level jurisdictional boundaries. Regional management options are seldom applied. This has in part also fuelled the proliferation of MSW incinerators, including smaller and recycled plants, which match smaller jurisdictions' waste generation and financial capacity; but tend to have more difficulty meeting environmental standards.

7. MSW incinerators may be publicly or privately owned. In the latter case, they are often established under a concession agreement between the municipal /district urban management bureau and an investor, whereby the former provides land and the latter investment capital.

8. Tipping fees, set by municipal governments and included in the concession agreement, are generally low compared to Western levels.[4] Often arrears in the payment of tipping fees accumulate since district governments face difficulty in collecting waste management fees from households. Recognizing this problem, the 12th FYP envisages increasing both the waste treatment levy and the level of fiscal subsidies. Furthermore, the above-referenced 'Suggestions for Further Strengthening MSW Management' recommends pushing forward tipping fee collection based on the "polluters pay" principle.

[3] In April 2012, NDRC issued a document requiring Yuan 0.65 /kilowatt hour (kWh) as universal tariff for power generated from MSW incineration, while the tariff for power plants using is Yuan 0.38-0.56/kWh.

[4] For example, in Kunming the tipping fee is Yuan 90 per ton, which is about USD 15/ton. In the United States, the tipping fee is generally around USD 50/ton or roughly Yuan 300/ton.

Regulatory Framework regarding MSW Incineration

9. At the national level, MSW management, including disposal, is under the purview of the Ministry of Housing, Urban and Rural Development (MOHURD). At the municipal level, urban management bureaus (UMBs) are responsible for MSW collection, transportation and disposal. UMBs are also responsible for construction and operation of disposal facilities, including landfills and incineration plants. The Ministry of Environmental Protection (MEP) issues standards for water, air and soil pollutant discharges/emissions. MEP's district level environmental protection bureaus (EPBs) are charged with monitoring MSW incinerators' air emissions, waste water discharges and fly ash disposal, and enforcing standards. This "institutional split" is different from many developed countries where environmental protection authorities are in charge of all aspects of MSW management.

10. An environmental impact assessment (EIA) is required prior to the construction of an MSW incinerator. The EIA document lays out in generic terms the operational and environmental standards that the plants must abide by. Construction of the plant may begin when the EIA is approved. Following a trial period, the plant is commissioned and may begin regular operations when it is certified that it fulfils the environmental requirements set out in the EIA. After commissioning, UMBs and EPBs monitor the plant strictly within the boundaries of their legislated mandates. Integrated monitoring of plant operating conditions and environmental impact is not prescribed in legislation and occurs rarely.

Dioxin Emissions and MSW Incineration

11. The dioxin release inventory in China's NIP identified waste incineration as the third largest among nine dioxin release sources in China, following ferrous and non-ferrous metal production, and heat and power generation. Few of China's MSW incinerators apply in their operations the Best Available Techniques (BAT) or Best Environmental Practices (BEP) defined in the Stockholm Convention (SC) on POPs in a comprehensive manner.[5] This is particularly true for older incinerators. Inadequate waste input control, operations management, and monitoring and control systems prevent optimal combustion, leading to dioxin formation in post-combustion zones. The high moisture content of the waste delivered to incinerators inhibits the combustion process, while chlorine containing waste fractions lead to dioxin precursors, both causing dioxin generation. Where air pollution control devices are not sophisticated, dioxins absorbed in small particulates remain in the flue gas and are emitted to the atmosphere. Sophisticated incinerators can reduce the formation of dioxins, but still have to address the problem of dioxins captured in the residues of pollution control devices. New facilities in large cities are generally designed in a way that they can limit emissions to below 0.1 ng toxic

[5] Best available techniques (BAT) for waste incineration include appropriate selection of site; waste input and control; techniques for combustion, flue gas, solid residue and effluent treatment. Best environmental practices (BEP) for waste incineration include appropriate off site procedures (such as overall waste management and consideration of environmental impacts of siting) and on site procedures (such as waste inspection, proper waste handling, incinerator operation and management practices and handling of residues). To achieve best results for environmental protection as a whole it is essential to coordinate the waste incineration process with upstream activities (e.g. waste management techniques, including notably waste reduction, reuse and recycling (3R)) and downstream activities (e.g. disposal of solid residues from waste incineration). Source: Stockholm Convention BAT/BEP Guidelines (http://chm.pops.int/Implementation/BATBEP/Guidelines/tabid/187/Default.aspx)

equivalent (TEQ)/Nm^3.[6] [7] However, often incinerator operators lack the skills and knowledge of BAT/BEP. There is no regulatory requirement for certification of incinerator operators; neither is there a training and certification program specially designed for incinerator operators.[8]

Regulatory Environment for the Management of Dioxin Emissions from MSW Incinerators

12. Chinese policy makers recognize the adverse environmental impacts that MSW incinerators may cause. The April 2011, State Council-endorsed 'Suggestions for Further Strengthening MSW Management' requires that compliance by MSW incinerators with emission standards be ensured. Plants are to establish daily monitoring and provide monthly reports to the UMBs and EPSs. Moreover, the UMBs' and EPBs' supervision capacity is also to be strengthened and the feasibility of introducing third-party professional institutions to implement supervision is to be explored. Finally, technical innovation in clean combustion, dioxin control, and safe fly ash disposal is to be promoted. The recent Development Research Center of the State Council and World Bank joint publication *Urban China: Toward Efficient, Inclusive, and Sustainable Urbanization* (2014) also calls for improved environmental management of waste disposal, in general and waste incineration, in particular.

13. Several technical codes issued by MOHURD regulate the operations of MSW incinerators. These include (i) *Technical Code for Projects of Municipal Solid Waste Incinerators* (CJJ90-2009), (ii) *Technical Specification for Operation, Maintenance and Safety of MSW Incinerators* (CJJ128-2009), and (iii) *MSW Incinerator and Heat Recovery Boiler* (GB/T18750-2008). The codes need to be updated to be more consistent with the Stockholm Convention BAT/BEP and to take into account the technical characteristics of the fluidized bed incineration technology, which is gaining more prominence in China.

14. MOHURD intends for all UMBs to continuously monitor incinerator operating conditions. To this end, MOHURD's 12th Five Year Program includes an initiative with an estimated cost of USD 330million to equip each city with an information technology (IT) based system to monitor every incinerator. The first step in this initiative would be for MOHURD to develop technical specifications and protocols for the IT systems.

15. With regard to dioxin emissions, on May 16, 2014 the Ministry of Environmental Protection (MEP) issued the revised Standard for Pollution Control on the Municipal Solid Waste Incineration (GB 18485-2014) replacing GB18485-2001. The new standard reduces the dioxin emission limit for MSW incinerators from 1.0 ng I-TEQ/Nm^3 to 0.1 ng I-TEQ/Nm^3. Existing incinerators must comply with the new limit value by January 1, 2016, while new MSW

[6] TEQ: Toxicity Equivalent Units. Dioxins and furans include various forms of PCDDs and PCDFs that present different level of toxicity. Chinese and international standards use the TEQ to measure the toxicity of dioxins and furans collectively based on a conversion methodology developed by the World Health Organization.

[7] With a suitable combination of primary and secondary measures, PCDD/PCDF performance levels in air emissions no higher than 0.1 ng I-TEQ/Nm^3 (at 11% O_2) are associated with best available techniques. It is further noted that under normal operating conditions emissions lower than this level can be achieved with a well-designed waste incineration plant. (Source: Stockholm Convention BAT/BEP Guidelines.) This level is also the limit in the European Union and Japan.

[8] By contrast, in the United States, certification of incinerator operators is mandatory. The American Society of Mechanical Engineers runs a comprehensive training and certification program.

incinerators must comply with it by July 1st, 2014. With this amendment, China has the same limit on dioxin emissions as Japan and the European Union.[9]

16. However, there are still some important regulatory weaknesses:

- Key regulations for the establishment and operation of MSW incinerators are essentially technical requirements for operating temperature of not less than 850° C and a residence time of not less than 2 seconds. Furthermore, the regulation does not specify the circumstances and durations when waste incinerators can have operating temperatures below 850° C, such as during start up and shut-down of incinerator units, or actions required to maintain the required combustion temperature. While there are some additional technical guidelines in place, they are not standards or regulatory requirements. There are no regulatory provisions for corrective actions against non-compliant incinerators.
- There is no legal requirement for regulators to monitor on a continuous basis, incinerator operating conditions and other indicators that, in the absence of the ability to continuously monitor dioxin emissions, allow detection of excessive dioxin emissions.[10]
- Requirements and conditions specified in the original EIA document that lead to the establishment of the waste incinerator do not form part of the site-specific operating conditions. Once the EIA is approved and the construction permit is issued, the content of the EIA document is almost never used as a regulatory requirement.
- Sampling and analysis of dioxin emissions is carried out once a year by an institute contracted by the incinerator operator. There are about 20 institutes with such capacity nationwide, mostly concentrated in the industrial eastern provinces. The *Standard for Pollution Control from MSW Incineration (GB 18485-2001)* requires that normal operating conditions be maintained at the time of sampling for dioxin emissions. However, EPBs do not have jurisdiction over waste management and the operating conditions of the waste incinerator. This situation leads to the critical issue that when dioxin emission is being sampled, no factual data are recorded on operating conditions that effect dioxin emissions, such as the waste feed rate, type of material being fed, fuel consumption, lime and activated carbon consumption. Consequently, when dioxin sampling is conducted once a year, there is no assurance that the waste incinerator is actually being operated under typical operating conditions.

[9] Prior to this amendment, China had made gradual, progress to reduce the standard to 0.1ng I-TEQ/Nm^3. Specifically, as per the 2008 official document on "Strengthening the Management of EIA for Biomass Power Generation Project", all EIAs for MSW incinerators issued after the publication of this document must require the 0.1ng I-TEQ/Nm^3 limit. Furthermore, since 2008, the local dioxin emission limit in Beijing and Shanghai is 0.1ng I-TEQ/Nm^3.

[10] In the absence of continuous information on dioxin emissions, data on operating parameters and indicators of whether combustion is optimized and whether dioxin formation from a combustion perspective is minimized are used. Carbon monoxide or total organic carbon, whether the minimum operating temperature (850 °C) and the minimum residence time (2 seconds) are such indicators. They can alert regulators to possible exceedance of the dioxin emission limit and allow them to stage inspections. Such regulatory capability would induce enterprises to maintain operating conditions at levels that would ensure compliance with the dioxin emission standard at all times.

- Chinese regulations stipulate that fly ash, which contains dioxins, heavy metals and other toxic pollutants, and, therefore, is toxic, be adequately treated and disposed of in hazardous waste landfills. However, this requirement is often not fulfilled due to high cost, unavailability of hazardous waste landfills, or poor enforcement.

Public Disclosure of Emission Data.

17. There are no clear requirements for the disclosure of dioxin emission test results to the public. In late 2013, MEP embarked on an initiative to disclose more pollution source information through the stipulation of key national, provincial and local pollution sources. Online monitoring air pollution data from key sources are to be disclosed to the public with one day of collection. As yet, MSW incinerators have not been classified as key national emission sources and dioxin emissions cannot be monitored on line. Some provincial EPDs have disclosed this information and may include MSW incinerators in their provincial lists of key pollution sources. In general, the lack of reliable information on pollutant emissions from MSW incinerators coupled with the public's general limited knowledge on the environmental and public health impacts of such emissions fuels the public's aversion to any MSW incineration, even where it has a legitimate place in an integrated MSW management system after maximizing other preferred waste management measures and follows BAT and BEP.

Demonstration Cities

18. The project will build capacity in two "demonstration cities", namely Kunming and Ningbo, for application of BAT/BEP. Kunming City is the capital of Yunnan Province and a typical growing second-tier city in China. In 2010, the urban area of Kunming City had a population of 4.85 million generating 4,850 tons of MSW per day. By 2015, the population is expected to reach 5.22 million generating 5,220 tons of MSW per day. In 2010, the daily MSW collection capacity in Kunming's urban areas was 6,133tons. Kunming has taken several notable initiatives to promote modern MSW management.[11] Having been designated by the central government as the MSW segregation demonstration city for Yunnan, Kunming is in the process of preparing a city-wide MSW segregation plan and looking for good models to learn from.

19. With regard to disposal of household waste, Kunming has decided to rely entirely on incineration. To this end, four incinerators, Dongjiao, Wuhua, Xishan, and Konggang, with a total processing capacity of 4,600tons per day were built between 2008 and 2010. Three of the incinerators employ the fluidized bed technology and one the mass burning technology. Both technologies are widely applied across China. As such, project experiences with these incinerators would be highly relevant for replication in other incinerators. Furthermore, being about to complete a fifth plant, Chenggong with a capacity of 700 tons per day, Kunming is also typical of cities with overdesigned infrastructure and associated operational budget constraints.

[11] Notably, being one of the first national pilot cities for waste recycling, since 2006 seven standardized recycling service kiosks and 452 recycling stations have been set up in residential areas. Furthermore, being one of 33 national demonstration cities of the treatment of restaurant waste, Kunming plans to build an anaerobic treatment plan for such waste. Finally, since 2010, a construction waste recycling has been underway, reducing the amount of nonorganic waste destined for disposal.

20. Konggang and Xishan had their EIA approved after 2008 and are therefore already subject to the 0.1ng TEQ/Nm^3 limit (see footnote to para 15). Wuhua and Dongjiao, on the other hand, will be subject to the 0.1 ng TEQ /Nm^3 limit from January 1, 2016.

21. Information on the incinerators' operating conditions over an extended period of time is scarce at best. In January 2013, Kunming UMB began requiring incinerators to provide monthly reports on operating conditions, by filling out a standard form. However, to date only one of the incinerators has provided such reports and data collected are incomplete. Furthermore, information requested in the form excludes important data, such as hourly operating temperatures during operations, flue gas oxygen concentration, and heavy metal emissions, as well as fly ash toxicity. Furthermore, not all data requested in the form, such as fuel consumption were adequately provided.

22. Under the proposed project, the above listed four "participating" incinerators would undergo thorough operational and environmental performance audits to determine the extent to which their current operations are consistent with Stockholm Convention BAT and BEP and the procedural and hardware improvements needed for them to fully comply with them. The incinerators that are committed to undertaking an improvement program and able to cover associated recurrent costs would be selected as "demonstration incinerators" and provided with project grant support for capital investments in necessary hardware to support them in their effort to consistently meet the newly enacted dioxin emission limit of 0.1ng TEQ /Nm^3. The project target is that at least three demonstration incinerators meet this level. Should fewer than three participating incinerators in Kunming meet the selection criteria, the project would seek to work with demonstration incinerators in other cities.

23. On the regulatory side, the Yunnan Environmental Protection Department (YEPD) has piloted, with UK Department for International Development support, integrated permits for wastewater discharges from industrial enterprises, a first in China. Kunming City wishes to use a similar approach to regulate MSW incinerators in line with national and Stockholm Convention requirements. With regard to information disclosure, Kunming UMB intends to use its existing state-of-the-art, interactive Digital Urban Management Platform (http://km12319.com) to publicize real-time MSW incinerator operating performance and (non-dioxin) emission data.

24. The other demonstration city, Ningbo has three incinerators, which process 2,950 tons of the 3,455 tons of MSW generated in the city daily.[12] The city is implementing the World Bank supported Ningbo Municipal Solid Waste Minimization and Recycling Project, which aims to assist selected districts in Ningbo Municipality to increase the volume and proportion of MSW recycled with processes for source separation and recycling. Under this project, Ningbo would receive support to institute in UMB and EPB capacity to continuously monitor incinerators' operating conditions and to strengthen the dioxin sampling and analysis capacity of the EPB dioxin laboratory. No hardware investments are foreseen for Ningbo's incinerators.

[12] Ningbo City may relocate one of the three incinerators during the lifetime of the project.

C. Higher Level Objectives to which the Project Contributes

25. The proposed project is consistent with Strategic Theme One: Supporting Greener Growth of the China – World Bank Country Partnership Strategy for Fiscal Year (FY) 2013-FY2016. Under this theme, the project would support Outcome 1.2: Enhancing Urban Environmental Services by "improving sanitation, solid waste and other basic urban services in selected second-tier cities, while reducing pollution" and Outcome 1.6: Demonstrating Pollution Management Measures, which would be achieved among others by "supporting efforts to reduce hazardous waste, by continuing to support the reduction of POPs—the byproducts of industrial production and the world's most toxic chemicals—from the regulatory level to emissions control and urban site cleanup."

26. The project is in line with the World Bank's corporate goals of eliminating extreme poverty by 2030 and boosting shared prosperity. By building capacity to reduce dioxin and furan emissions from MSW incinerators, it contributes to the well-being of poorer communities living in the vicinity of such facilities.

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO/GEO

27. The objective of the project is to build capacity and demonstrate best available techniques and best environmental practices in MSW incineration in accordance with the Stockholm Convention.

B. Project Beneficiaries

28. Direct project beneficiaries would include (i) two demonstration city EPBs and UMBs whose regulatory capacity will be enhanced; (ii) three demonstration incinerators whose ability to comply with the relevant technical standards and the new dioxin emission limit will be improved; and (iii) local communities (of approximately 25,000 people, of which about 12,100 are females) around demonstration incinerators who would be exposed to lower levels of dioxin emissions. China as a whole will benefit from taking steps to comply with the Stockholm Convention in the area of MSW incineration. The global community will benefit also from lower dioxin and furan emissions.

C. PDO Level Results Indicators

29. There would be one PDO level results indicator:

"Regular and reliable monitoring data show operating practices that consistently lower dioxin levels to 0.1 ng TEQ/m3 at selected demonstration incinerators."

30. Two supplemental indicators further define the PDO indicator.

i) A planned schedule of improvements in operating procedures established after measuring and evaluating the baseline situation; and

ii) Achievement of milestones set for the improvement of operating procedures as identified in the schedule of improvements in operating procedures.

III. PROJECT DESCRIPTION

A. Project Components

31. The project would support three components: (1) Capacity Building for Improved Operation and Regulation of MSW Incinerators, (2) Capacity Building for Improved MSW Management Planning, and (3) Project Management.

Component 1: Capacity Building for Improved Operation and Regulation of MSW Incinerators

(Cost: USD 27.44m. Funding: USD 9.83m GEF, USD 17.61 m FECO, MOHURD, incinerators, KEPB, KUMB, YEPD, NEPB)

32. This component would support two closely linked sub-components aiming to increase capacity to better operate and regulate MSW incinerators so as to reduce dioxin and other pollutant emissions.

Sub-component 1A. Building Capacity for Improved Incinerator Operations and Emissions Control

(Cost: USD 19.55m. Funding: USD 6.23 m GEF, USD 13.32m incinerators)

33. This sub-component would increase capacity at selected demonstration incinerators to improve operations and reduce dioxin and other pollutant emissions in line with Stockholm Convention BAT/BET.

34. The project would support operational and environmental performance audits at four candidate demonstration incinerators in Kunming, namely Dongjiao, Xishan, Konggang and Wuhua, during the first year of project implementation. Based on the audits, an operational improvement program would be designed for each incinerator. Incinerators that commit to implementing these programs *and* fulfill financial eligibility conditions would be supported during the remainder of the project, including through grant funding for necessary upgrades of equipment relevant for dioxin emission reduction. The project will aim to achieve operational improvements at three demonstration incinerators. If more than one of Kunming's four candidate incinerators fails to meet the above-named conditions, the Project may turn to Ningbo or other cities for eligible demonstration incinerators.

35. Specifically, the project would support the following activities:

a) *Operational and environmental performance audits* that would be carried out during the first 9-12 months of project implementation to fill the information gap on operating conditions at four incinerators in Kunming (Konggang, Wuhua, Xishan, and Dongjiao) and investments in equipment at these incinerators needed to enable monitoring and their online transmission to Kunming UMB and Kunming EPB. Experts of MSW operations with substantial international and domestic experience

would be hired to design and conduct the audits and help design the operational improvement programs.

b) *Dissemination of lessons learned from the audits in Kunming* to regulators and incinerator managers in other cities across China. The project would finance a consultancy and incremental costs of dissemination to raise awareness on the linkages between operating conditions and environmental performance for two widely used technologies in China.

c) *Operational improvement programs, including capital investments in dioxin reducing equipment* that would be implemented in the demonstration incinerators that commit to such programs *and* meet financial eligibility criteria, during the remainder of project life with the help of manuals of operational procedures. These programs will be governed by operational improvement agreements, which will be signed by Kunming Municipality and the demonstration incinerators before the programs begin and will lay out the terms and conditions of the programs.

d) *BAT and BEP training for approximately 250 MSW incinerator managers and operators* of which 50 would be from Kunming and Ningbo incinerators, and the rest from 40 MSW incinerators across China.

Sub-component 1B. Capacity Building for Improved Regulation of MSW Incinerators

(Cost: USD 7.89 m. Funding: USD 3.60m GEF, USD 4.29 m FECO, MOHURD, KUMB,KEPB, YEPD, and NEPB)

36. This sub-component would support five activities to promote improved regulation of MSW incinerators:

a) *Piloting of integrated permits*[13] *for selected incinerators*, which would specify in detail incinerator operating conditions required to meet emission limits for dioxin and other pollutants, as laid out in the operational improvement programs (Component 1Ab). The permits would also include inspection manuals for the regulators.

b) *Building capacity for improved monitoring by regulators* through:

i. Procurement of IT hardware and software to allow Kunming and Ningbo UMBs and EPBs continuous online access to incinerator operating and emission data;

[13] An integrated permit is a facility-specific operating license that would set out the operating and performance requirements for the waste incinerator, including such items as:
1. Feedstock management - storage facility for inbound waste, including leachate control, processing (feed rate and size reduction), sampling of waste composition, and characterization.
2. Combustion unit performance and emission limits - range of operating parameters, including temperatures, oxygen, HCl, CO, start up and shutdown procedures, ash removal and treatment and testing process, etc.
3. Database management, record keep, information disclosure, staff training and contingency planning
4. All requirements set out in the EIA document, hence operationalizing the conditions under which the facility was approved.
The integrated permit will specify the overall manner in which the waste incinerator shall be operated so as to reduce potential environmental impacts. Contravention to any terms of requirements will be deemed as violation to any of the regulations, therefore may attract a range of enforcement actions subject to the severity of the violation.

ii. Stack tests for dioxin where standards for such tests are enforced, including maintenance of normal operating conditions at the time of sampling;

iii. Enhancing the capacity of the Ningbo dioxin laboratory through the purchase of equipment and technical assistance.

c) *Training of regulators* from MOHURD and Ningbo and Kunming EPBs and UMBs through study tours to North American and European cities where BAT/BEP for MSW incineration are implemented;

d) *Updating and developing four national-level technical standards for MSW incinerator operations*; and

e) *Public awareness raising and disclosure of incinerator operating and emissions data* on the internet (Kunming and Ningbo) and on community bulletin boards (Kunming).

Component 2. Capacity Building for Improved MSW Management Planning

(Cost: USD1.75m. Funding: USD 1.57m GEF, USD 0.18m FECO, MOHURD)

37. This component would support four activities to promote improved MSW management planning with a view to reduce solid waste going to MSW incinerators:

a) *A study on regional planning of MSW disposal* that would identify cost effective disposal options at a regional scale (national level activity)*;*

b) *A* national level *study on the system of statistical indicators and MSW classification;*

c) *Twinning of Kunming and Ningbo on MSW segregation; and*

d) *An assessment of the impact of MSW segregation on dioxin emissions in Ningbo.*

38. Under this component the project would also support *project* results *monitoring and dissemination* activities.

Component 3. Project Management

(Cost: USD 3.72m. Funding: 0.60m GEF, USD 3.12m FECO, YEPD, NEPB)

39. The project would fund incremental operating costs and consultancy costs associated with project management, including day-to-day project implementation, procurement and financial management, environmental safeguards carried out by the Foreign Economic Cooperation Office (FECO), the Yunnan Project Management Office (PMO), and the Ningbo PMO (see Annex 3 for implementation arrangements).

B. Project Financing

40. The project would be funded through a USD12 million GEF grant and USD20.91 million counterpart funds.

41. Additionally, the project would be complemented by the implementation of activities under the Ningbo Municipal Solid Waste Minimization and Recycling Project worth about USD

30 million. The Stockholm Convention Guidelines on BAT/Guidance on BEP emphasize the importance for environmental protection of coordinating the waste incineration process with upstream management techniques and of considering activities to minimize waste, notably resource recovery, reuse, recycling, waste separation in MSW management planning.[14] By providing USD 246 million to waste minimization, including notably through source segregation, the above-mentioned Ningbo loan project strongly complements the GEF grant activities for the attainment of the PDO. Under Component 2, the GEF grant would support an assessment of the impact of MSW segregation in project districts on dioxin emissions from an incinerator that receives waste stream from those districts. The study would help the incinerator adjust its operating conditions in accordance with the evolving waste composition. Results of the study will also inform other Chinese cities' integrated MSW management plans. Specifically, Kunming and Ningbo will be twinned with the objective of Kunming city and district MSW management officials to learn directly from their counterparts' hands-on experiences in implementing the segregation and recycling activities. As such, the Ningbo loan project is part of the baseline, while the GEF grant funded activities are incremental. However, in general, both World Bank loan and GEF grant funded activities should be viewed as parts of the larger joint Government of China – World Bank effort to promote environmentally sustainable MSW management in China.

Project Cost and Financing (USD)

Project Components	Project cost	GEF Financing	% Financing
1. Capacity Building for Improved Operation and Regulation of MSW Incinerators	27,440,000	9,830,000	35.8
2. Capacity Building for Improved MSW Management Planning	1,750,000	1,570,000	89.7
3. Project Management	3,720,000	600,000	16.1
Total Costs			
Total Project Costs	32,910,000	12,000,000	36.5
Front-End Fees	0	0	
Total Financing Required	32,910,000	12,000,000	36.5

C. Lessons Learned and Reflected in the Project Design

42. Two key lessons learned from initiatives to improve MSW incinerator environmental performance around the world and from World Bank-supported projects in China have been reflected in the project design.

a. *Emphasize learning.* MSW incinerators are complex plants, whose operation requires high levels of skills. Initiatives that aim to improve these plants' environmental performance need to emphasize skill building and learning by the incinerator operators and managers in addition to regulatory measures and public information disclosure.

[14] http://chm.pops.int/Implementation/BATandBEP/Guidance/tabid/3636/Default.aspx. Accessed on May 27, 2014.

b. *Support interventions for which there is institutional ownership by line ministries*. *Activities that do not have an institutional champion are likely to fail during project implementation.* The project would support technical activities under Component 2 in which MOHURD has expressed strong interest as they complement its ongoing work on modernizing MSW management in China. MOHURD has committed to providing active technical oversight over the implementation of these activities.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

43. FECO has established a Project Management Office (henceforth "FECO PMO") to be in charge of overall project implementation in coordination with the project management offices in Kunming and in Ningbo (see below). FECO PMO would also be responsible for overall project result monitoring, and for preparing annual progress reports, based on input from the Yunnan and Ningbo PMOs. FECO PMO would execute the national level activities under Components 1 and 2, while technical oversight would be provided by relevant units of MOHURD.

44. In Kunming, the existing PMO of the Yunnan Urban Environment Project established at the Environmental Cooperation Office under Yunnan Provincial Environmental Protection Department (henceforth "Yunnan PMO") would take the responsibility for overall project monitoring and coordination for Kunming activities. Yunnan would establish a Project Leadership Group to be headed by the responsible vice mayor of Kunming Municipality and vice director Yunnan EPD, and comprising Kunming UMB, Kunming EPB, Kunming Finance Bureau, and the Kunming Development and Reform Commission.

45. In Ningbo, a Project Management Office established at the Ningbo Solid Waste Management Center under the Ningbo Municipal EPB (henceforth "Ningbo PMO") will be responsible for project management, coordination and implementation of Ningbo related activities under Component 1 and 2.

46. Institutional responsibilities for financial management and procurement are presented under "VI. Appraisal Summary" below. Please refer to Annex 3 for details.

B. Results Monitoring and Evaluation

47. Project results would be monitored continuously to gauge progress towards the PDO. FECO would manage the overall Monitoring and Evaluation (M&E) system and provide the Bank with semi-annual implementation progress reports (see Annex 3 for details.) The PMOs in Kunming and Ningbo would carry out M&E of the activities that they execute, as detailed in Annexes 1 and 3. They would transmit the information to FECO through semi-annual reports.

48. The project results framework, including indicators, baseline values and targets, is presented in Annex 1. Baseline values and targets for the PDO indicator "Regular and reliable monitoring data show operating practices that lower dioxin levels to 0.1ng TEQ /m^3 at three demonstration incinerators" and one of the supplemental PDO indicators "Achievement of

milestones set for the improvement of operating procedures as identified in the schedule of improvements in operating procedures at three demonstration incinerators" will be determined through the first year operational and environmental performance audits. This follows naturally from the project design, in which the said audits are key elements of capacity building for the participating and demonstration incinerators. As discussed elsewhere in this PAD, the lack of environmental and operational data on Kunming's incinerators necessitates such thorough audits. The cost and length of the audits require that they are carried out during project implementation with project proceeds, rather than during project preparation. Specifically, the audits will determine the baseline operating conditions prevailing during the audit period, and establish targets for improved conditions during the subsequent years of project implementation.

C. Sustainability

49. The recent harmonization of the Chinese dioxin emission limit for MSW incinerators with the internationally accepted 0.1ng TEQ/m3 level will strongly motivate the demonstration incinerators to embrace the operational improvements supported by the project. However, enforcement of the new limit will be key for the sustainability of the operational improvements. Project supported measures under Component 1B would strengthen local and national regulators' enforcement capacity, although limited local EPB and UMB staff capacity in terms of educational background and staff numbers will continue to be a constraint.

50. The incinerators' ability to finance the recurrent costs associated with improved operations would also significantly impact these practices' sustainability. Therefore, the project would select incinerators that pass a financial eligibility test as demonstration incinerators. Kunming City has also committed to working with all participating incinerators to devise a "financial viability action plan", which is discussed in more detail under "VI. Appraisal Summary".

51. Continuous monitoring of operating conditions by KUMB and NUMB is likely to be sustainable as MOHURD is committed to promoting this practice nationwide. The national level new/updated standards will fill a regulatory void, especially in the wake of the new, more stringent dioxin emission standard.

V. KEY RISKS AND MITIGATION MEASURES

A. Risk Ratings Summary Table

Risk Category	Rating
Stakeholder Risk	Substantial
Implementing Agency Risk	
- Capacity	Substantial
- Governance	Moderate
Project Risk	
- Design	Moderate

Risk Category	Rating
- Social and Environmental	Moderate
- Program and Donor	Low
- Delivery Monitoring and Sustainability	Substantial
Overall Implementation Risk	Substantial

52. The above listed risks and associated mitigation measures are presented in the Operational Risk Assessment Framework in Annex 4.

B. Overall Risk Rating Explanation

53. The overall implementation risk is rated substantial given the key substantial risks listed below together with measures to mitigate them.

- Risk: The Bank's involvement in the MSW incineration sector may be misinterpreted as support to waste incineration over other disposal methods rather than as an effort to improve existing incinerators' environmental performance.

  Mitigation measure: The project's aim to reduce MSW incinerations' negative environmental impact is clearly elaborated in the project documents and will be emphasized in project awareness raising activities.

- Risk: The implementing agency FECO's limited technical capacity in MSW management and the limited project management capacity in Ningbo, one of the demonstration cities, may slow down project implementation.

  Mitigation measure: FECO will retain expert advisors, and MOHURD will provide technical oversight. Other municipal agencies and FECO will assist the Ningbo PMO in project management.

- Risk: Inadequate monitoring and enforcement capacity in Kunming municipal and district EPBs and municipal UMB may endanger the sustainability of the project demonstrated BAT/BEP.

  Mitigation measure: The project will support a number of monitoring and enforcement capacity measures under Component 1B; but staff limitations will remain an issue.

- Risk: The weak financial status of the candidate demonstration incinerators in Kunming may limit their ability to cover the recurrent costs associated with improved operations and environmental management.

  Mitigation measure: Kunming City will work with the participating incinerators to devise a financial viability action plan and prepare annual progress reports for each demonstration incinerator. Furthermore, commitment to implementing an operational improvement program and the ability to finance all recurrent costs associated with the said program will be among the selection criteria for

demonstration incinerators. Legally binding operational improvement agreements will be signed between the demonstration incinerators and Yunnan Province. Furthermore, Yunnan Province will provide annual reports on the environmental performance of all participating incinerators.

VI. APPRAISAL SUMMARY

A. Financial and Economic Analysis

54. As in most environmental projects focusing on capacity building, financial viability and sustainability of key project beneficiaries is key to project viability and sustainability. Therefore, a financial analysis of the four potential demonstration incinerators in Kunming under Component 1 was carried out (see Annex 6). For each incinerator, the analysis focused on (i) the company's general financial health, and (ii) its ability to raise counterpart funds required by the GEF[15]. Another important issue, namely (iii) the plant's ability to cover the recurrent costs, including spare parts of equipment associated with operational practices that are consistent with BAT and BEP was not addressed due to incomplete information on current operational practices. Such operational requirements will be designed and the associated recurrent costs will be estimated based on the findings of the first-year operational and environmental performance audits. At that time each candidate plant's financial ability to cover these costs in a consistent manner will be analyzed.

55. In general, Kunming's incineration capacity has been overdesigned in an expectation of a major population influx to the Kunming metropolitan area and underestimating the availability and cost of transferring waste from rural areas. Consequently, incinerators have received less waste than had been guaranteed in their contracts with the UMB, which has affected their financial status. Furthermore, inability of district governments to recover collection and disposal costs from beneficiary households has hampered their ability to pay the incinerators the agreed tipping fees fully and in a timely manner. Analysis of two-year financial data indicates that

- Of the four companies, Dongjiao, Kongang and Wuhua are profit making enterprises. However, Konggang's and Dongjiao's profitability is significantly affected by unavailability of sufficient waste and low tipping fees. Xishan failed to make profits in 2012 and 2013 due to below-capacity waste delivery and low tipping fees. Xishan's mother company has sustained the plant through loans. However, from early 2014 the plant has been receiving waste from two counties so it can operate closer to capacity.
- Dongjiao, Konggang and Wuhua are expected to be able to secure the requisite counterpart funds, either from own resources or bank loans due to adequate cash reserves, cash flows, and/or adequate debt to asset ratios. In the case of Xishan, the mother company has indicated that it would cover the counterpart costs.

[15] Counterpart funds required were determined based on a set of preliminary capital investments identified during project preparation. Investments to be supported by the project under the operational improvement program will be determined based on the findings of the first-year operational and environmental performance audits and may be different the set of investments identified during project preparation.

56. District UMBs accumulated significant arrears over the past years, especially impacting Dongjiao and Wuhua, and to a lesser extent Konggang. An agreement to settle about 60% of these arrears over 2014-2016 has been reached. Such payments will further improve these companies' ability to cover counterpart costs.

57. District UMBs have improved their fee collection ability by linking waste management fees to water bills. However, the collection rate is still at about 72% and is not expected to improve to more than 90%. As such, new arrears are likely without a formal transfer by the municipal finance bureau. An agreement to settle the remaining 40% of the arrears is still outstanding.

58. A selection criterion for Kunming incinerators to benefit from project grant support for capital investments under an operational improvement program will be demonstration of ability to provide co-financing for BAT/BEP investments and to finance recurrent costs associated with improved operations, as discussed under Component 1A.

59. Kunming City has committed to working with each participating incinerator to devise a "financial viability action plan" that would include, *inter alia:* (i) all expenditures estimated to be incurred by the incinerators during a five year period following the completion of the operational and environmental performance audits, including debt service and capital expenditures; (ii) the estimated resources available to the incinerators, including revenues from their own operations, tipping fees, borrowings and equity; and (iii) proposed actions to ensure the continued financial viability of the incinerators.

60. The economic justification for this project is driven by the benefits of reducing the severe probable health impacts of releasing toxic chemicals, including dioxins and furans, into the environment as a result of improper management of solid waste incinerators. Not only are these chemicals a risk to people in the immediate vicinity of the incinerators at the time of release, but they are known to be persistent in the environment for long periods of time and can be disbursed widely by wind and along the food chain. Clean-up after the fact is expensive or impossible. Developed countries have recognized the high cost of health and environmental impacts from dioxin and furan releases, and have developed stringent emission standards for their emission from MSW incinerators. These standards are reflected in the Stockholm Convention BAT and BEP. They are a balance between minimizing the health and environmental risk of emissions release and the cost and technical feasibility of reducing these emissions. As a signatory of the Stockholm Convention, China is committed to minimizing dioxin and furan emissions from its growing MSW incineration sector and seeks to demonstrate the BAT and BEP suggested by the Stockholm Convention at Kunming's incinerators. Since this is a pilot project to demonstrate, test and adapt these BAT and BEP to local conditions; and adaptation of these solutions will be site specific; no ex-ante cost analysis of the specific technical options was available. Cost effectiveness will be one factor considered when developing the operational improvement program at each site during the first year of the project.

B. Technical

61. A first-line assessment of operational management among Kunming's four candidate incinerators concluded that all plants have in varying degrees scope for improvements in system

control to stabilize process conditions and optimize for a broader range of process and environmental parameters than what is now considered for daily operations. There is also substantial scope to integrate monitoring of process and environmental parameters and use more comprehensive data from this for process control and optimization. This will require investments in equipment for process control (instrumentation, control system, environmental monitoring), a thorough review and modification of operational procedures and corporate management commitment of the participating plants to make the required efforts to implement improvement programs. In addition, for some plants additional investments are required, e.g. in the waste reception and waste pretreatment areas (see plant briefs in Annex 6).

62. Shortcomings in environmental monitoring, scope for improvement in process control and additional investments needs can be determined in the comprehensive operational and environmental performance audits that are scheduled under the project for all participating plants and should form the basis for the operational improvement programs and plant management agreement to implement these programs including the required counterpart funded investments.

63. All plants have a satisfactory level of maintenance and management, operational skill sets and control systems should be adequate as the starting point for the envisaged improvement programs. Although tight financial management is apparent, is seems that the plants have opportunities for investments when needed. This should be confirmed when specific investments needs are identified during the initial performance audits.

64. One observation was that certain environmental monitoring elements are not working (sometimes for longer periods), that a substantial number of recordings are off or questionable, that calibration and verification are below required standards and that also certain critical process parameters (such as temperature) are not systematically monitored for environmental monitoring / enforcement purposes. The improvement programs with the waste incinerators should therefore be mirrored by matching monitoring and enforcement programs by the regulators (EPB).

65. The emphasis of the project would be on learning not only by the participating incinerators on improved operations but also by regulators and policy makers from the actual operating conditions in typical MSW incinerators that deal with various constraints. Given the increasing trend in Chinese cities to dispose of MSW through incinerations, the operating and emission data collected and lessons learned during the implementation of the improvement programs would be valuable for policy makers and regulators to improve such plant's environmental performance across China.

66. The IT hardware and software to be procured for the regulators in Kunming and Ningbo will allow them the closely monitor the incinerators' performance, building on existing IT capabilities. The continuous sampling equipment to be acquired for the Ningbo Dioxin Laboratory will allow the laboratory to conduct more reliable sampling and take more samples at lower costs. Additionally, the overall technical capabilities of the laboratory will be enhanced though staff training and cross verification of laboratory QA& QC procedures with other international and national laboratories.

C. Financial Management

67. The project will be implemented at the national level and in two demonstration cities, Ningbo and Kunming. The PMO established under Foreign Economic Cooperation Office (FECO PMO) will be responsible for overall project monitoring and coordination with the Yunnan and Ningbo PMOs. It is also responsible for national level project management, implementation and financial management activities, including project accounting and financial reporting.

68. The existing Yunnan Urban Environment Project PMO (YPMO), established at the Environmental Cooperation Office under Yunnan Provincial Environmental Protection Bureau (EPB), will be responsible for project monitoring and coordination of Kunming activities and daily FM work for the non-BAT/BEP demonstration activities. It will also provide guidance and monitoring to the four selected Kunming incinerators that will implement BAT/BEP demonstration activities and the related project FM and disbursement activities.

69. In Ningbo, project implementation and daily project FM work, including project accounting and financial reporting, will be carried out by the Project Management Office (Ningbo PMO) established at Ningbo Solid Waste Management Center under Ningbo Municipal Environmental Protection Bureau (NEPB).

70. One centralized designated account (DA) will be opened and maintained by the Ministry of Finance (MOF). The withdrawal applications will be submitted to FECO PMO for review through Yunnan and Ningbo PMOs before going to MOF for further review and disbursement.

71. The Project financial management (FM) capacity assessment of the implementing agencies and finance bureaus identified the lack of knowledge and experience in managing Bank financed projects by the Ningbo PMO and four incinerators financial staff as the principal FM risk. To address this risk, the following risk management measures have been agreed: (a) preparation and issuance of Financial Management Manual (FMM) by FECO PMO, acceptable to the Bank, to standardize project FM procedures; (b) extensive FM training from the Bank; and (c) Yunnan PMO, and FECO PMO will arrange extensive workshops and experience sharing. The FMM have been reviewed and accepted by the Bank.

72. With implementation of these proposed actions, the FM arrangements will satisfy the World Bank's minimum requirements under OP/BP 10.00. See Annex 3 for additional information.

73. The FM capacity assessment concluded that the Project FM arrangements satisfy Bank requirements and identified the following principal risk: the Ningbo PMO and the four incinerators financial staffs lack knowledge and experience in managing Bank financed projects. The following mitigation measures to address the above risk have been agreed: (a) preparation and issuance of Financial Management Manual by FECO PMO, acceptable to the Bank, to standardize project FM procedures; (b) extensive FM training from the Bank; and (c) Yunnan PMO and FECO PMO will arrange extensive workshops and experience sharing. Overall, the residual project FM risk after mitigation is assessed as Moderate.

D. Procurement

74. FECO PMO will conduct procurement for national level activities while Yunnan PMO and Ningbo PMO will be responsible for procurement for the respective activities in Kunming and Ningbo. The only exception will be procurement related to the dioxin emission stack tests in Kunming, which would be handled by FECO PMO. The responsibilities for the procurement of individual contract packages have been clearly identified in the project procurement plan.

75. The lack of experience with World Bank financed projects of the procurement staff in the Ningbo PMO, and possible influence of domestic procurement practice on project implementation are the principal risks. In view of these risks, the following mitigation actions have been agreed: (i) The Bank provided training to the project implementing agencies during project preparation and will provide continuous procurement training during project implementation, including on good contract management practices and the Anti-Corruption Guidelines. (ii) FECO PMO to provide oversight on procurement conducted by the Ningbo and Yunnan PMOs, strengthen communications between implementing agencies and to facilitate knowledge sharing. (iii) Hand holding and just-in-time procurement support to be provided to the PMOs by the Bank's procurement specialist; (iv) Integrated financial management, procurement and technical reviews by the Bank during project supervision missions Overall procurement risk is rated moderate.

76. The PMOs have prepared a detailed and comprehensive procurement plan covering the entire scope of the project. The procurement plan (which includes contracts expected to be procured in advance of Grant signing) has been reviewed and agreed with the Bank. It shall be updated throughout the duration of the project at least annually. Further details on procurement are provided in Annex 3.

E. Social (including Safeguards)

77. The social impacts of the proposed project would be mainly positive. The primary project beneficiaries will be the local environmental protection bureaus in two cities of Kunming and Ningbo and local residents in four districts of Kunming. They will benefit from strengthened capacity for solid waste management and reduced exposure to dioxin emissions from MSW incinerators.

78. A social assessment was carried out through extensive consultation with various stakeholders, a questionnaire survey with local residents, a desk review, and participator observations. The assessment aimed at:

- Identifying the primary stakeholders, and their interests and needs, and their potential impacts on the project and environment;
- Learning the potential positive and negative impacts, and social risks of the project;
- Learning public perceptions and ideas of information disclosure on the project and air emissions, identifying the primary stakeholders' needs for information disclosure and public participation, and developing strategies suited to local culture and customs;

- Proposing a social management plan that optimizes the project design, improves information disclosure and promotes public participation through extensive consultation, thereby evading risks and promoting the realization of the project objectives.

79. Topics discussed with stakeholders ranged from waste management in general, such as service coverage and waste management fees, to incineration in particular, including the stakeholders' perceptions of health and other impacts of incineration, as well as pollution control technologies that may be supported by the project. The findings of the social assessment reinforced the fact that public reactions against dioxin emissions from MSW incinerators have become more common in China's large cities in recent years, and there is also significant lack of confidence in the information shared with the public on these emissions.

80. The social assessment found that women declared to know less than men about hazardous emissions from incinerators, but women expressed more concern about incinerators' impact on health and quality of life. Women were also less aware than men of environmental information disclosed by incinerators and less satisfied with the information disclosed. Women were significantly more interested in information on health impacts than men. Finally, women differed from men in their preferred mode of access to information. These differences have been reflected in the information disclosure plan in Kunming.

81. The main outcome of the social assessment was a public information disclosure and public awareness raising strategy, which have been fully incorporated in project design (see Annex 3) and results indicators. Notably, during the project, local communities' awareness of information disclosure of incinerators pollutant emissions will be monitored, in a gender-disaggregated way, as part of the Project Results Framework (Annex 1).

82. Land acquisition for purposes of construction of four incinerators in Kunming City took place prior to this project. The land acquisition was completed without anticipation to the proposed project. Nevertheless, a retroactive review of the land acquisition was carried out. The review covered the significance of the resettlement impacts (including notably, total amount of land acquired, number of people affected), legal frameworks, compensation standards, institutional arrangements, grievance redress mechanism, and livelihood and living standards. The review concluded that although the land acquisition was implemented mainly followed the relevant government policies and regulations, it was consistent with the requirements of the Bank Policy on Involuntary Resettlement OP 4.12. All affected people interviewed were satisfied with the compensation and process and no complaints have been received so far.

83. The Grievance Redress Mechanism that will be established in Kunming will cover grievances concerning the deficient performance or coverage of Project activities, including any grievances related to legacy issues for land acquired for the construction of four MSW incineration plants in Kunming City.

84. There are no ethnic minority communities in the project area.

F. Environment (including Safeguards)

85. The project would have direct environmental benefits by reducing dioxin emissions from MSW incinerators through strengthening regulatory monitoring and enforcement capacity, improving operations, building up operator skills, and publicizing incinerators operating data. Proposed physical activities under the project are primarily equipment enhancement of air pollution control facilities of existing MSW incinerators in Kunming. Key environmental issues identified are associated with incinerator operation: including air emissions control, solid waste management, wastewater management, and environmental risks. Due to the nature of the project and risk level of potential environmental impacts, the project is categorized as Category A for environmental purposes as per OP4.01/BP4.01 Environmental Assessment.

86. An environmental audit (EA) and an environmental management plan (EMP) for each incinerator and an EA Executive Summary for the entire project were prepared and found in compliance with national and Bank requirements. The EMPs were developed based on the findings of the EA reports, and include detailed information on organizational arrangements and responsibilities for environmental management and supervision, mitigation measures, a training plan, a monitoring plan, a public engagement plan, a risk management plan, and budget estimates for EMP implementation for construction and operation stages.

87. Two rounds of public consultations and information disclosure were held following domestic and Bank requirements during the project preparation stage. A combination of opinion surveys and public meetings within the project's area of influence were conducted. Public concerns were incorporated either in the project design or in the EMP. Information disclosure was carried out as part of the environmental assessment and the social assessment, through public bulletins, local newspapers, and the internet. All draft EAs and EMPs were made available locally on March 10, 2014, and in the World Bank InfoShop on March 25, 2014, and as such, are accessible to the general public. The subsequently updated EAs and EMPs were disclosed in the World Bank Infoshop on August 15, 2014.

Annex 1: Results Framework and Monitoring

CHINA: Municipal Solid Waste Project

Results Framework

Global Environmental Objectives

PDO Statement

The project objective is to build capacity and demonstrate best available techniques and best environmental practices in municipal solid waste incineration in accordance with the Stockholm Convention.

These results are at	Project Level

Global Environmental Objective Indicators

		Cumulative Target Values					
Indicator Name	Baseline	2015	2016	2017	2018	2019	End Target
Regular and reliable monitoring data show operating practices that lower dioxin levels to 0.1 ng TEQ/m3 at three demonstration incinerators. (Text)	TBD based on first year audits	Baseline TBD on first year audits	Baseline TBD based on first year audits	TBD based on first year audits	TBD based on first year audits	TBD based on first year audits	TBD based on first year audits
A planned schedule of improvements in operating procedures established after measuring and evaluating the baseline situation at three demonstration incinerators. (Yes/No - Sub-Type: Supplemental)	No	No	Yes	Yes	Yes	Yes	Yes
Achievement of milestones set for the improvement of operating procedures as identified in the schedule of improvements in operating procedures at three demonstration incinerators (Text - Sub-Type: Supplemental)	TBD based on first year audits	TBD based on first year audits	TBD based on first year audits	TBD based on first year audits	TBD based on first year audits	TBD based on first year audits	TBD based on first year audits

Intermediate Results Indicators

Indicator Name	Baseline	Cumulative Target Values					
		2015	2016	2017	2018	2019	End Target
KEPB and KUMB have continuous access to data on operating conditions and emissions from all five Kunming incinerators (Yes/No)	No	No	Yes	Yes	Yes	Yes	Yes
NEPB has continuous access to data on operating conditions and emissions from all three incinerators in Ningbo. (Yes/No)	No	No	Yes	Yes	Yes	Yes	Yes
Data on operating conditions and emissions disclosed to public in Kunming (Yes/No)	No	Yes	Yes	Yes	Yes	Yes	Yes
Operating conditions of five incinerators posted on the web (Yes/No - Sub-Type: Supplemental)	No	No	Yes	Yes	Yes	Yes	Yes
Information on environmental impacts of four incinerators posted on community bulletin boards (Yes/No - Sub-Type: Supplemental)	No	Yes	Yes	Yes	Yes	Yes	Yes
Dioxin emission test results for five incinerators in Kunming posted on the web (Yes/No - Sub-Type: Supplemental)	No	Yes	Yes	Yes	Yes	Yes	Yes
Operating conditions of three Ningbo incinerators posted on the web (Yes/No)	No	No	Yes	Yes	Yes	Yes	Yes
Public awareness of incinerator information disclosed (Percentage)	13.70	15.00	25.00	30.00	40.00	50.00	50.00

Awareness of females of incinerator information disclosed (Percentage - Sub-Type: Breakdown)	9.30	12.00	20.00	25.00	40.00	50.00	50.00
Awareness of males of incinerator information disclosed (Percentage - Sub-Type: Breakdown)	18.80	18.80	30.00	35.00	40.00	50.00	50.00
Kunming district EPBs inspect each of five incinerators once per year on the basis of integrated permit (Yes/No)	No	No	No	No	Yes	Yes	Yes
Integrated permit finalized for each incinerator (Yes/No - Sub-Type: Supplemental)	No	No	No	Yes	Yes	Yes	Yes
Number of regulators trained through study tours to northern America and Europe (Number)	0.00	0.00	18.00	18.00	36.00	36.00	36.00
Number of incinerators nationwide with at least five supervisors and operators trained in BAT/BEP (Number)	0.00	0.00	7.00	20.00	30.00	40.00	40.00
Dioxin emissions from demonstration incinerators (Text)	Baseline to be determined at end of first year audits	Baseline	0.1 ng TEQ/m3	0.1 ng TEQ/m3	0.1 ng TEQ/m3	0.1 ng TEQ/m3	0.1 ng TEQ/m3
Ningbo Lab standard operating procedure assessed as consistent with international good practices (Text)	No	No	No	No	No	Yes	Yes
Number of standards revised/developed (Number)	0.00	0.00	0.00	1.00	2.00	3.00	3.00

Annex 2: Detailed Project Description

China: Municipal Solid Waste Management Project Name

1. The project would support three components to achieve the Project Development Objective (PDO): (1) Capacity building for improved operation and regulation of MSW incinerators; (2) Capacity Building for Improved MSW Management Planning; and (3) Project Management.

Component 1. Capacity Building for Improved Operation and Regulation of MSW Incinerators

(Cost: USD 27.44m. Funding: USD 9.83m GEF, USD 17.61 m FECO, MOHURD, incinerators, KEPB, KUMB, YEPD, NEPB)

2. This component would support two closely linked sub-components aiming to increase capacity to better operate and regulate MSW incinerators so as to reduce dioxin and other pollutant emissions.

Sub-component 1A. Building Capacity for Improved Incinerator Operations and Emission Control

(Cost: USD 19.55 m. Funding: USD 6.23 m GEF, USD 13.32m incinerators).

3. This Sub-component would increase capacity at selected demonstration incinerators to improve operations and reduce dioxin and other pollutant emissions in line with Stockholm Convention BAT/BET. Specifically, the project would support operational and environmental performance audits and operational improvements programs, train incinerator managers and operators, and investments in enhanced air pollution control equipment.

4. The project would support operational and environmental performance audits at four candidate demonstration incinerators in Kunming, namely Dongjiao, Xishan, Konggang and Wuhua, during the first year of project implementation. Based on the audits, an operational improvement program would be designed for each incinerator. Incinerators that commit to implementing these programs and fulfill financial eligibility conditions would be supported during the remainder of the project, including through grant funding for necessary upgrades of equipment relevant for dioxin emission reduction. The project will aim to achieve operational improvements at three demonstration incinerators. If more than one of Kunming's four candidate incinerators fails to meet the above-named conditions, the project may turn to Ningbo or other cities for eligible demonstration incinerators.

a) **Operational and Environmental Performance Audits,** Operational and environmental performance audits would be carried out during the first 9-12 months of project implementation to fill the information gap on operating conditions at the four Kunming incinerators. As part of these audits, Kunming UMB and Kunming EPB would collect in a systematic manner periodic information on operating parameters, including notably combustion temperature, residual oxygen, carbon monoxide, flue gas flow rate; emission of HCl, SO_2, NOx, mercury and other heavy

metals, and total suspended particulates; incoming waste characteristics; and combustion residuals, including bottom and fly ash. The monitoring of these data would be carried out through continuous emission monitoring (CEM) and/or stack sampling and waste characterization. Two stack tests for dioxin emissions per plant would also be carried out during this period.

The project would finance investments in equipment at the said four incinerators needed to enable the monitoring of the above parameters at each line of plants and their online transmission to UMB and EPB (Sub-component 1B). This equipment includes devices to monitor flue gas and activated carbon in each of the lines of the four incinerators.

Experts of MSW operations with substantial international experience would be hired to design and conduct the audits and help design the operational improvement programs. The consultants would evaluate the collected data together with Kunming UMB and EPB, and determine weaknesses and areas for improvements in the incinerators' operations. Jointly with the companies, UMB and EPB, the consultants would develop customized operational improvement programs. The program would define baselines, targets and milestones for the improvement of operating procedures in the facility. To help implement the program, site-specific *manuals of operational procedures* would also be developed.

The operational and emission data would have the added value of presenting the real life situation of operations in MSW incinerators that are typical of medium size cities in China and will allow testing the application of improved procedures so they can be replicated.

b) **Dissemination of Lessons Learned from the Audits in Kunming,** the project would finance a consultancy and incremental costs of dissemination to raise awareness among regulators and incinerator managers in other cities across China on the linkages between operating conditions and environmental performance in two widely used technologies in China.

c) **Implementation of Operational Improvement Programs Including Capital Investments in Dioxin Reducing Equipment,** the operational improvement programs would be implemented in the demonstration incinerators that commit to such programs and meet financial eligibility criteria, during the remainder of project life with the help of manuals of operational procedures. These manuals would also be part of the pilot integrated permits (Sub-component 1B). Progress would be monitored according to set milestones, which would also be part of the Project Results Framework (Annex 1).

The financial eligibility conditions would include (i) ability to provide counterpart financing for capital investments; and (ii) ability to fund incremental operating and maintenance (O&M) costs and the cost of spare parts associated with the operating procedures prescribed in the operational improvement program and with the new equipment supported by the Project. Data on the incremental O&M and spare parts costs would be collected as part of the operational and environmental audits.

Those incinerators that commit to implementing the operational improvement program and meet the financial eligibility criteria would be selected to receive grants for investments in equipment that, together with operational improvements would ensure consistent attainment of the 0.1ng TEQ/m^3 dioxin emission standard. The capital investments for each incinerator will depend on the needs identified as part of the operational and environmental performance audits.

The operational improvement programs will be governed by operational improvement agreements, which will be signed by Kunming Municipality and the demonstration incinerators before the programs begin and will lay out the terms and conditions of the programs.

d) **Training of Incinerator Managers and Operators,** the project would fund consultant services to design training materials and train approximately 250 MSW incinerator managers and operators[16] in BAT and BEP. The program would be implemented in three phases: (i) training of eight trainers, and (ii) training of approximately 50 managers and operators from eight incinerators in Kunming and Ningbo, and (iii) training of approximately 200 managers and operators from about 40 incinerators across China. Based on the experience with the pilot program, consultants would prepare recommendations for the institution of a training and certification requirement for MSW incinerator operators.

***S*ub-component 1B. Capacity Building for Improved Regulation of MSW Incinerators**

(Cost: USD 7.89 m. Funding: USD 3.60m GEF, USD 4.29 m FECO, MOHURD, KUMB, KEPB, YEPD, and NEPB)

5. Under this Sub-component, the project would support (a) piloting of integrated permits for MSW incinerators; (b) improved monitoring by regulators; (c) training of regulators; (d) updating and developing technical standards for MSW incinerator operations; and (e) public disclosure of incinerator operating and emissions data.

(a) **Piloting Integrated Permits for MSW Incinerators in Kunming[17],** the project would fund consultants to help Kunming regulators develop and implement, on a

[16] Operations managers, furnace operation supervisors, furnace operators, air pollution control device managers and operators.

[17] An integrated permit is a facility-specific operating license that would set out the operating and performance requirements for the waste incinerator, including such items as:

1. Feedstock management - storage facility for inbound waste, including leachate control, processing (feed rate and size reduction), sampling of waste composition, and characterization.
2. Combustion unit performance and emission limits - range of operating parameters, including temperatures, oxygen, HCl, CO, start up and shutdown procedures, ash removal and treatment and testing process, etc.
3. Database management, record keep, information disclosure, staff training and contingency planning
4. All requirements set out in the EIA document, hence operationalizing the conditions under which the facility was approved.

The integrated permit will specify the overall manner in which the waste incinerator shall be operated so as to reduce potential environmental impacts. Contravention to any terms of requirements will be deemed as violation to any of the regulations, therefore may attract a range of enforcement actions subject to the severity of the violation.

pilot basis, integrated permits for five participating MSW incinerators in Kunming. Such integrated permits would specify in detail incinerator operating conditions required to meet emission limits for dioxin and other pollutants, including monitoring and inspection requirements. Plant specific standard operating procedures would be developed and attached to the permits. As such, the integrated permits, together with other activities supported under this Sub-component, would help some of the gaps in the current regulatory system described under "C. Sectoral and Institutional Context" above. As part of this activity, an inspection manual would also be developed.

The project would also support EPB and UMB staff from Ningbo to visit Kunming to learn about Kunming's experience with the pilot integrated permit program.

(b) **Improved Monitoring of MSW Incinerators,** the project would demonstrate better monitoring by (i) enabling continuous access by regulators to incinerator operating and emission data; (ii) stack emission testing for dioxin following standards, and (iii) enhancing the capacity of the Ningbo Dioxin Laboratory.

i. *Enabling Continuous Access by Regulators to Incinerator Operating and Emission Data,* The project would fund investments in IT systems to transmit in real time and continuously data from MSW incinerators to the environmental protection bureaus (EPBs) and urban management bureaus (UMBs) in Kunming and Ningbo. In Kunming, the project would support the procurement and installation of software and hardware for data acquisition and storage, and system development for monitoring and sharing and dissemination. Kunming UMB's existing state-of-the-art Digital Urban Management Platform would be used to publicize real-time operating performance and (non-dioxin) emission data. In Ningbo, the project would finance the procurement and installation of software and hardware for data acquisition, communication and storage, and system development for monitoring/supervision and sharing and dissemination.

Under this heading, the project would also support a consultancy to develop national guidelines and a standard system framework for the collection and processing of MSW incinerator emission and operating data. Specifically, the activity would recommend national standards to be for local and provincial supervision and regulatory agencies for securing real-time data for incinerator performance, and guide and harmonize the development of the online monitoring of incinerator operations for EPBs and UMBs across China. The study would incorporate lessons learned from the above-mentioned project investments in Kunming and Ningbo. This activity would be implemented under MOHURD Environmental Sanitation Department's technical oversight.

ii. *Dioxin Stack Testing following Standards*, in Kunming, the project would fund one stack test annually at each selected demonstration incinerator in addition to the one test per year that facilities are required to carry out by law, in order to gauge the impact of improved operations and investments on dioxin emissions. The baseline tests would be carried out during the initial period of operational and environmental performance audit (Sub-component 1A). Kunming UMB and EPB

will jointly ensure that normal operating conditions prevail at the time of sampling.

iii. *Enhancing Ningbo Dioxin Laboratory Capacity*, the project would fund equipment and various training activities and technical assistance to improve the capacity of the Ningbo EPB's dioxin laboratory. The equipment to be procured would include a continuous sampler and a set of sampling probe. The continuous sampler would be used in the assessment of the impact on dioxin emissions of MSW segregation (see Sub-Component 1B below). The project would also support laboratory staff participation in the annual POPs forum in China and in international annual dioxin conferences; the lab's participation in international and domestic quality assurance and quality control (QA&QC) assessments; and specialized training for four laboratory staffers in laboratory operations, including sampling, sample preparation, analysis, QA&QC procedures, and use of laboratory equipment. Furthermore, an international dioxin lab specialist would be hired to assist the laboratory in reviewing and revising its standard operating procedures.

(c) **Training of Regulators,** the project would support 8-10 day study tours to North American and European cities where BAT and BEP for MSW incineration are implemented. Staff of MOHURD and of the Kunming and Ningbo EPBs and UMBs would participate in these study tours. The regulators would learn about permitting, monitoring and inspection, and enforcement methods employed by their counterparts to ensure incinerators' compliance with dioxin and other emission standards.

(d) **Updating and Developing Technical Standards for MSW Incineration,** the revised dioxin emission standard for MSW incinerators, 0.1ng TEQ/Nm^3 will require updating of three existing technical specifications and standards: (i) *Technical Specifications for MSW Incineration Facilities (CJJ90-2009),* (ii) *Technical Specification for Operation, Maintenance and Safety of MSW Incinerators (CJJ128-2009),* and (iii) *MSW Incinerator and Heat Recovery Boiler (GB/T18750-2008).* Among others, the revised regulations would address the existing weaknesses regarding operational practices. The project would fund consulting services to this end. Additionally, recognizing that MSW incinerators often realize dioxin into the environment by improperly disposing of fly ash, the project would fund consultants to develop a new *Standard for the Solidification and Disposal of Fly Ash after Waste Incineration.*[18] The Research Institute of Standards and Norms of MOHURD would provide technical oversight to the implementation of this activity.

(e) **Public Awareness Raising and Disclosure of Emission Data and Public Awareness Raising on Dioxin,** in Kunming and Ningbo, key emission and plant data

[18] Updating/development of these new standards is not a precondition for the successful implementation of the BAT/BEP demonstration investments in four Kunming incinerators under Component 2, because the pilot integrated permits that will be developed for the demonstration incinerators will incorporate similar guidelines. Rather, it is envisaged that the updating of the above listed standards will benefit from the lessons learned from those investments.

would be disclosed on a website that the general public can access at will. Thus, a concerned citizen could observe real time SO_2, CO, NO_x and other emissions (monitored real time by CEMs); several key process variables such as the furnace temperature, and activated carbon feed rate; and periodic postings of annual stack test results for dioxins, heavy metals and the like.

In Kunming, information about the four incinerators' environmental performance including with regard to dioxin emissions would be communicated to the public using also other channels, such as community bulletin boards, which were identified by the Social Assessment as the most effective channel.

Component 2. Capacity Building for Improved MSW Management Planning

(Cost: USD1.75m. Funding: USD 1.57m GEF, USD 0.18m FECO, MOHURD),

6. This component would support four activities to promote improved MSW management planning with a view to reduce solid waste going to MSW incinerators: (a) A study on regional planning of MSW disposal; (b) a study on the system of statistical indicators and MSW classification; (c) twinning of Kunming and Ningbo on MSW segregation; and (d) an assessment of the impact of MSW segregation on dioxin emissions in Ningbo.

(a) **Study on Regional Planning of MSW Disposal,** the project would fund consultancy services to carry out an optimization study in a city to identify cost effective disposal options at a regional scale. Recognizing that MSW disposal planning that is restricted to municipal or district boundaries has led to a proliferation of MSW incineration facilities, some of which end up operating below capacity due to a shortage of feedstock, these studies would aim to demonstrate that jurisdictional barriers would be economically more efficient. A regional facility would also have better chances to operate at capacity, be financially sound, and as a consequence, better able to meet the operating conditions required for low dioxin emissions as prescribed in the new standard. The MOHURD Environmental Sanitation Department would provide technical oversight.

(b) **Study on System of Statistical Indicators and MSW Classification,** recognizing that the current waste classification in the Chinese statistical system is not conducive to planning for MSW segregation, the project would fund a consultancy to study and recommend a new set of statistical indicators. The study would focus on one or two pilot cities to identify feasible indicators. The MOHURD Environmental Sanitation Department would provide technical oversight.

(c) **Twinning of Kunming and Ningbo on MSW Segregation,** the project would support study tours and workshops in Ningbo for Kunming UMB and EPB staff to learn about Ningbo experiences in the design and implementation of waste recycling and source separation under the World Bank loan-funded Ningbo Solid Waste Minimization and Recycling Project. Kunming delegations would interact with and learn the perspectives of four levels of project implementation units in Ningbo,

namely municipality, district, sub-district and neighborhood resident committee, and witness the public promotion campaign piloted in the selected communities.

(d) **Assessment of Impact of MSW Segregation on Dioxin Emissions in Ningbo,** the impact of waste segregation at household level, a BEP for waste incineration according to Stockholm Convention guidelines, on dioxin emissions would be assessed in Ningbo where a sizeable program to promote such segregation is about to begin. The focus of the said program on household kitchen waste (other recyclable content of waste, including most plastics, are generally already segregated out by waste pickers) is opportune since the high organic content of MSW in China is one of the factors that make it costly for incinerators to maintain the combustion temperature at a level required to minimize dioxin emissions. The findings of the study would help Chinese MSW management authorities to better plan integrated MSW management. The assessment would be closely coordinated with the ongoing Ningbo Solid Waste Minimization and Recycling Project. Dioxin emissions would be measured at the newly built Everbright Environmental Protection Energy (Ningbo) Co. Ltd, which will receive segregated waste for disposal. The project would fund consultants and dioxin testing.

(e) **Results Monitoring and Dissemination,** the project would fund incremental operating costs and consultancy costs associated with results monitoring and with workshops, website and publications for the nationwide dissemination of lessons learned from project activities Broad dissemination of project information would allow demonstrated project activities to be replicated in other cities.

Component 3. Project Management

(Cost: USD 3.72m. Funding: 0.60m GEF, USD 3.12m FECO, YEPD, NEPB)

7. The project would fund incremental operating costs and consultancy costs associated with project management, including day-to-day project implementation, procurement and financial management, environmental safeguards carried out by the Foreign Economic Cooperation Office (FECO), the Yunnan Project Management Office (PMO), and the Ningbo PMO (see Annex 3 for implementation arrangements).

Annex 3: Implementation Arrangements

China: Municipal Solid Waste Management Project

Project Institutional and Implementation Arrangements

1. The project will be implemented at the national level and in two demonstration cities, Ningbo and Kunming. A Project Management Office at the Foreign Economic Cooperation Office (FECO PMO) will be in charge of overall project implementation in coordination with the project management offices in Kunming and in Ningbo. In Kunming, the existing PMO of the Yunnan Urban Environment Project at the Environmental Cooperation Office under the Yunnan Provincial Environmental Protection Department (Yunnan PMO) will manage project activities in Kunming. In Ningbo, a Project Management Office established at the Ningbo Solid Waste Management Center under Ningbo Municipal Environmental Protection Bureau (Ningbo PMO) will be responsible for project management, coordination and implementation for Ningbo related activities. Relevant branches of the Ministry of Housing, Urban and Rural Development will assign staff to FECO PMO to provide technical oversight on activities within their purview. Similarly, in Kunming and Ningbo, the Urban Management Bureaus (UMB) and Environmental Protection Bureaus (EPB) will participate in implementing and or overseeing project activities. These responsibilities are discussed in detail below and summarized in Table 1.

Financial Management, Disbursements and Procurement

Financial Management

2. The FM capacity assessment concluded that the Project FM arrangements satisfy Bank requirements and identified the following principal risk: the Ningbo PMO and the four incinerators financial staffs lack knowledge and experience in managing Bank financed projects. The following mitigation measures to address the above risk have been agreed: (a) preparation and issuance of Financial Management Manual by FECO PMO, acceptable to the Bank, to standardize project FM procedures; (b) extensive FM training from the Bank; and (c) Yunnan PMO and FECO PMO will arrange extensive workshops and experience sharing.

3. Overall, the residual project FM risk after mitigation is assessed as Moderate.

4. The project will be implemented at the national level and in two demonstration cities, Ningbo and Kunming. FECO PMO will be responsible for overall project monitoring and coordination with the Kunming and Ningbo PMOs. It is also responsible for national level project management, implementation and financial management activities including project accounting and reporting.

5. The existing Yunnan Urban Environment Project PMO (YPMO) established at the Environmental Cooperation Office under Yunnan Provincial EPB will be responsible for project monitoring and coordination of Kunming activities and daily FM work for the non-BAT/BEP demonstration activities. It will also provide guidance and monitoring to the four selected Kunming incinerators that that will implement BAT/BEP demonstration activities and the related project FM and disbursement activities.

6. In Ningbo, the project implementation and daily project FM work, including project accounting and financial reporting will be carried out by the Project Management Office (Ningbo PMO) established at Ningbo Solid Waste Management Center under Ningbo Municipal Environmental Protection Bureau (NEPB).

7. **Budgeting.** The counterpart funds will be from governments' contributions and self-financing of implementing agencies (IAs). The annual work plan, including the funding budget and the resources, will be prepared by each implementing agency and reviewed and consolidated by the relevant PMOs before going to FECO PMO for final review. In addition, the budget for counterpart funds committed by governments will be reviewed and approved by its People's Congress and be included in their sector budget. Based on the approved budget and implementation progress, the related finance bureaus will provide government appropriations to the project. Budget variance analysis will be conducted on a semi-annual basis to inform management of significant variances from plan that may need corrective actions. The Bank will work with the implementing agencies and relevant PMOs to supervise the project budgeting system, to enhance budget preparation, and budget execution reporting during project implementation.

8. **Funds flow.** The GEF grant will flow from the World Bank into the centralized designated account (DA) that will be set up and managed by MOF. The withdrawal applications will be submitted to FECO PMO for review by Yunnan and Ningbo PMOs before going to MOF for further review and disbursement. MOF will reimburse funds to the IAs for the GEF financed portion paid first by the IAs or disburse funds directly to the contractors.

9. **Accounting and financial reporting.** The administration, accounting and reporting of the project will be set up in accordance with Circular #13: "Accounting Regulations for World Bank Financed Projects" issued in January 2000 by the MOF. The standard set of project financial statements has been agreed between the World Bank and MOF.

10. All the implementing agencies are existing entities with adequately staffed financial departments. Computerized accounting systems, Yongyou, Yuanguang and Xiaomifeng have been adopted by the IAs for years and separate project accounting profile will be set up in the existing system according to requirements of Circular#13. The project FM related roles and responsibilities have been clearly defined.

11. The FECO PMO, Ningbo PMO, Yunnan PMO and the four incinerators will be responsible for day-to-day project FM related matters, including project accounting and project financial reporting. Original supporting documents will be retained by the implementing agencies. The project financial statements will be prepared by each implementing agency. For the Kunming component, Yunnan PMO will consolidate the project financial statements. FECO PMO will be responsible for review and consolidating the interim unaudited financial reports (IFRs) based on input from Yunnan and Ningbo PMOs and for furnishing to the World Bank the consolidated IFRs no later than 60 days after the end of each calendar semester in form and substance satisfactory to the Bank.

12. The task team will monitor the accounting process, including the adequacy of the financial management system, especially during the initial stage to ensure complete and accurate financial information are provided in a timely manner.

13. **Internal control.** The project implementing agencies have adequate financial management regulations in place. In addition, the project related accounting policy, procedures and regulations were issued by MOF, and the FMM will be prepared and issued to standardize the project FM procedures.

14. **Audit.** The Audit Service Center of the China National Audit Office (CNAO) for Foreign Loan and Assistance Projects has been identified as auditor for the grant. Annual audit report will be issued by the above audit office. The CNAO has extensive experience with the Bank financed operations. According to the World Bank Policy on access to Information, the audit report for all investment lending operations for which the invitation to negotiate was issued on or after July 1, 2010, need to be made publicly available in a timely fashion and in a manner acceptable to the Bank. Audit reports will be made publicly available on the website of CNAO. Following the World Bank's formal receipt of the audited financial statements from the borrower, the World Bank will also make them available to the public in accordance with the World Bank Policy on Access to Information. The responsible agency and timing is summarized as follows:

Audit Report	**Submitted by**	**Due date**
Consolidated Project Financial Statements audited by Audit Service Center of CNAO	FECO PMO	June 30 of each calendar year

Disbursements

15. Three disbursement methods are available to the project: advance, reimbursement, and direct payment. Supporting documents required for Bank disbursement under different disbursement methods will be documented in the Disbursement Letter issued by the Bank.

16. One segregated DA in US dollar will be opened at a commercial bank acceptable to the Bank and will be managed by MOF. The ceiling of each DA will be determined and documented in the Disbursement Letter.

17. The World Bank grant would be disbursed against eligible expenditures (taxes inclusive) as in the following table:

Category	**World Bank Grant (USD Millions)**	
	Allocated Amount	**Percentage of Expenditures to be financed**
(1) Goods, non-consulting services, and consultants' services, Incremental Operating Costs, and Training and Workshops under MOEP's part of the Project	2,780,000	100%
(2) Goods, non-consulting services, and consultants' services, Incremental Operating Costs, and Training and Workshops under Yunnan Province's part of the Project	7,820,000	100%

(3) Goods, non-consulting services, and consultants' services, Incremental Operating Costs, and Training and Workshops under Ningbo Municipality's part of the Project	1,400,000	100%
Total	**12,000,000**	

18. Retroactive financing will be available for eligible expenditures under all project components up to an aggregate amount not to exceed US$2.4 million for payments on or after September 11, 2014.

19. **Supervision Plan.** The supervision approach for this project is based on its FM risk rating, which will be evaluated on regular basis by the FMS in line with the FMSB's FM Manual and in consultation with relevant task team leader. The initial FM supervision will focus on financial staff training and compliance of the Bank's FM and disbursement related requirements as well as the quality and timeliness of project accounting and financial reporting.

Procurement

20. **Institutional responsibilities**. FECO PMO will manage the procurement aspects of national level activities under Components 1, 2 and 3, as well as dioxin emission monitoring of Kunming incinerators under Component 1. The Ningbo PMO will carry out procurement of Ningbo activities under Component 1, under the tutorship of an experienced procurement specialist of a separate PMO that manages the Bank Ningbo Solid Waste Recycling Project. In Kunming, the Yunnan PMO will be responsible for implementing the entire procurement process for project activities in Kunming, except for the procurement of stack testing for dioxin emissions. FECO PMO has considerable experience in procurement under Bank-financed projects while the Yunnan PMO has some experience.

21. **Capacity Assessment**. The main findings of the procurement capacity assessment were (i) MOHURD and the NingboPMO have little experience in the selection, employment and management of consultants under Bank financed projects; (ii) there is possible influence of domestic procurement practice which may lead to possible delays and non-compliance with Bank Procurement and Consultant Guidelines during project implementation.

22. **Risks.** The lack of experience with World Bank financed projects of the procurement staff in the Ningbo PMO and possible influence of domestic procurement practice on project implementation are the principal risks. The mitigation measures agreed to include: (i) The Bank provided procurement training during project preparation and will provide continuous procurement training during project implementation, including on good contract management practices and the Anti-Corruption Guidelines. (ii) FECO PMO to provide oversight for procurement conducted by Yunnan and Ningbo PMOs, strengthen communications between implementing agencies and facilitate knowledge sharing. (iii) The Bank will provide hand-holding and just-in-time procurement support to the PMOs. (iv) Integrated fiduciary and technical reviews to be carried out by the Bank during supervision missions to review procurement, contract management, implementation progress and financial management under the project. Overall procurement risk is rated as Moderate.

23. **Applicable Guidelines**. Procurement will be carried out in accordance with the "Guidelines: Procurement of Goods, Works and Non-Consulting Services under IBRD Loans and IDA Credits & Grants by World Bank Borrowers" dated January 2011; and "Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits & Grants by World Bank Borrowers" dated January 2011; and the provisions stipulated in the Loan Agreement. National Competitive Bidding (NCB) shall be carried out in accordance with the Law on Tendering and Bidding of the People's Republic of China promulgated by Order of the President of the People's Republic of China on August 30, 1999 subject to the modifications stipulated in the Legal Agreement in order to ensure consistency with Bank Procurement Guidelines.

24. **Procurement of Goods.** Goods procured under this project will include various equipment, instruments, software and hardware for performance and environmental monitoring of MSW incinerators. Procurement will be done using the Bank's Standard Bidding Documents for all International Competitive Bidding (ICB) and National Model Bidding Documents agreed with or satisfactory to the Bank for all NCB.

25. **Selection of Consultants.** Consulting services to be procured under the project include various contracts for Institutional Capacity Building. Operational and Environmental Performance Audit, Project Management, Results Monitoring, Information Dissemination, Updating and Developing Technical Standards for MSW Incineration and Technical Assistance. Selection of firms will be conducted using the Bank's Standard Request for Proposals for all Quality- and Cost- Based Selection (QCBS) and Quality- Based Selection (QBS). Consutlants that are Universities and Research Institutions may be considered for selection under the circumstances and in accordance with the provisions in paragraphs 1.13(c) and 2.8 of the *Consutlant Guidelines*.

26. **Training, Workshops and Study Tours**. Plans for training, workshops and study tours will be developed by the PMO and included in the annual project work plan for Bank review. Expenditures incurred in accordance with the approved plans for training and workshops will be the basis for reimbursement.

27. **Procurement Plan.** The procurement plan prepared by the PMOs has been reviewed and agreed with the Bank. It will be made available in the project's records and on the Bank's external website. The Procurement Plan will be updated annually or as required to reflect implementation needs and improvements in institutional capacity.

28. **Frequency of Procurement Supervision**. Prior review supervision will be carried out through the World Bank Office in Beijing. Procurement post reviews will be carried out by the Bank and/or external auditors every 12 months. The procurement post review sampling ratio will be one out of fifteen contracts.

29. **Thresholds for Prior-Review and Procurement Method**. The initial thresholds for procurement / selection method and prior review are indicated in the table below:

Thresholds for Procurement Method

Description	Thresholds	
Goods	(--)	ICB
	< US$3,000,000	NCB
	<US$100,000	Shopping
Consultant Services	(--)	QCBS/ QBS
	<=US$300,000	CQS

Thresholds for Prior Review

Description	Contracts subject to Prior Review	
Goods	ICB	All
	NCB	First 2 NCB goods contracts by each PIU irrespective of value and all contracts >=US$3,000,000
	Direct Contracting	All
Consulting Services	Consulting firm competitive selection	First contract by each PIU for each selection method irrespective of value and all contracts >=$300,000
	Individual consultant selection	Only in exceptional cases. Identified in procurement plan.
	SSS (firm)	All
	SSS (individual)	>=$20,000
	CQS	First CQS contract by each PIU irrespective of Value.

ICB=International Competitive Bidding; NCB=National Competitive Bidding; QCBS=Quality and Cost Based Selection; QBS=Quality-Based Selection; CQS= Selection Based on the Consultants' Qualifications; SSS=Single Source Selection; IC=Individual Consultant selection procedure; " – " = Not Applicable

30. **Advance Contracting and Retroactive Financing.** Contracts expected to be procured and signed in advance of Grant signing have been identified in the agreed procurement plan for the project and are subject to Bank prior review. Any payments made under such contracts prior to the date of signature of the Grant Agreement will be eligible for retroactive financing of up to a maximum of US$2.4 million and within the limits specified in the Grant Agreement.

Table1. Summary institutional arrangements

Ref.	Activity	Who will provide service, works, goods / deliver output	Day-to-day management[19] [20]	Financial Management	Disbursement	Procurement	Technical Oversight [21]	Results Monitoring[22]
Component 1. Capacity building for improved operation and regulation of MSW incinerators								
1A. Building Capacity for Improved Incinerator Operations and Emission Control								
1Aa	Operational and Environmental Performance Audits	Incinerators / Consultant[23] / KUMB and KEPB	FECO PMO	FECO PMO	FECO PMO and MOF	FECO PMO	FECO, KUMB, KEPB and YEPD	FECO PMO
1Ab	Dissemination of lessons learnt from audits	Incinerators / Consultant / KUMB and KEPB	FECO PMO	FECO PMO	FECO PMO and MOF	FECO PMO	FECO, KUMB, KEPB and YEPD	FECO PMO
1Ac	Operational Improvement Program Implementation	Incinerators / Consultant / KUMB and KEPB	YPMO	YPMO	YPMO and YPFB	YPMO	KUMB and KEPB	YPMO
	Investments in Improved Equipment	Providers	Incinerators	Incinerators and YPMO	Incinerators, YPMO, and YPFB	YPMO	KUMB	YPMO
1Ad	Training of Incinerator Managers and Operators	Consultant	FECO PMO	FECO PMO	FECO PMO and MOF	FECO PMO	MOHURD Env. Sanitation Dept.	FECO PMO
1B. Capacity Building for Improved Regulation of MSW Incinerators								
1Ba	Piloting integrated permits for MSW incinerators in Kunming	Consultant	YPMO	YPMO	YPMO and YPFB	YPMO	KEPB and YEPD	YPMO
1Bb	Kunming: Procurement of IT hardware and software for continuous monitoring	Provider	YPMO	YPMO	YPMO and YPFB	YPMO	KUMB and KEPB	YPMO
	Ningbo: Procurement of IT hardware and software	Provider	NEPB CIEE	NPMO	NPMO and NMFB	NPMO	NEPB CIEE	NPMO

[19] YPMO: Yunnan PMO, YEPD: Yunnan Environmental Protection Department; YPFB: Yunnan Provincial Finance Bureau; MOF: Ministry of Finance; NPMO: Ningbo PMO; NMFB: Ningbo Municipal Finance Bureau; KUMB: Kunming Urban management Bureau, KEPB: Kunming Environmental Protection Bureau, NUMB: Ningbo Urban Management Bureau, NEPB: Ningbo Environmental Protection Bureau; CIEE: Center for Information and Environmental Education; NMC: Ningbo Environmental Monitoring Center

[20] Refers to management of consultant/provider, ensuring that work gets done, output/service/good is provided

[21] Refers to TOR/bidding document / technical specification review and validation, evaluation of consultant qualifications, review of proposals /bids, review of consultant outputs

[22] Refers to entity that will collect results information on the relevant results indicator and periodically report to FECO PMO for overall Project results monitoring

[23] There may be multiple consultant or providers.

Ref.	Activity	Who will provide service, works, goods / deliver output	Day-to-day management[19] [20]	Financial Management	Disbursement	Procurement	Technical Oversight [21]	Results Monitoring[22]
	National guidelines for online transmission of incinerator data	Consultant	FECO PMO	FECO PMO	FECO PMO and MOF	FECO PMO	MOHURD Env. Sanitation Dept.	FECO PMO
	Dioxin monitoring	Provider	FECO PMO	FECO PMO	FECO PMO & MOF	FECO PMO	KUMB and KEPB	YPMO
	Enhancing Ningbo Dioxin Lab Capacity	Consultant and provider	NPMO	NPMO	NPMO & NMFB	NPMO	NEMC	NPMO
1Bc	Kunming Regulator training		YPMO	YPMO	YPMO	Not applicable	YEPD	YPMO
	Ningbo Regulator training		NPMO	NPMO	NPMO & NMFB	Not applicable	NEPB	NPMO
	National Regulator training		FECO PMO	FECO PMO	FECO PMO	Not applicable	FECO	FECO PMO
1Bd	Updating and developing standards	Consultant	FECO PMO	FECO PMO	FECO PMO & MOF	FECO PMO	MOHURD Research Institute of Standards and Norms	FECO PMO
1Be	Disclosure of data on website in Kunming	KUMB, KEPB, and YEPD	YPMO	Not applicable	Not applicable	Not applicable	KUMB, KEPB and YEPD	YPMO
	Disclosure of data on website in Ningbo	NEPB CIEE	NPMO	Not applicable	Not applicable	Not applicable	NEPB	NPMO
	Public awareness raising in Kunming	Consultant	YPMO	YPMO	YPMO & YPFB	YPMO	KUMB and KEPB	YPMO
	Public awareness monitoring	Consultant	YPMO	YPMO	YPMO & YPFB	YPMO	KUMB and KEPB	YPMO
Component 2. Capacity Building for Improved MSW Management Planning								
2a	Study on regional planning of MSW disposal	Consultant	FECO PMO	FECO PMO	FECO PMO & MOF	FECO PMO	MOHURD Env. Sanitation Dept.	FECO PMO
2b	Study in system of statistical indicators and MSW classification	Consultant	FECO PMO	FECO PMO	FECO PMO & MOF	FECO PMO	MOHURD Env. Sanitation Dept.	FECO PMO
2c	Twinning of Kunming and Ningbo on MSW Segregation	NEPB, NUMB, Beilun EPB and UMB, and	YPMO & NPMO	YPMO & NPMO	YPMO and YPFB, NPMO and NMFB	Not applicable	KUMB and NUMB	YPMO &NPMO

Ref.	Activity	Who will provide service, works, goods / deliver output	Day-to-day management[19] [20]	Financial Management	Disbursement	Procurement	Technical Oversight [21]	Results Monitoring[22]
		KEPB, KUMB						
2d	Ningbo Assessment	Consultant	NPMO	NPMO	NPMO and NMFB	NPMO	NEPB and NUMB	NPMO
2e	Information Dissemination	Consultant	FECO PMO, YPMO	FECO PMO, YPMO,	FECO PMO & MOF, YPMO & YPFB,	FECO PMO KPMO	FECO	FECO PMO, YPMO
Component 3. Project Management								
3A	Project Management		FECO PMO, YPMO, NPMO	FECO PMO, YPMO, NPMO	FECO PMO & MOF, YPMO & YPFB, NPMO & NMFB			

Environmental and Social (including Safeguards)

Environmental Safeguards

31. By design, four existing MSW incinerators in Kunming may receive GEF funding to invest in enhanced equipment in order to implement operational improvement programs (Component 1Ad). As a precondition to receive the funding, each of the four incinerators will be subject to an intensive operational and environmental performance audit in the first year of project implementation in order to develop the operational improvement programs. In accordance with World Bank OP/BP4.01, the project is categorized as Category A for environmental purposes due to the sensitivity of dioxins emissions and MSW incineration, to the nature of the project, and to the risk level of potential environmental impacts. Dioxins are extremely biologically toxic and persistent in the environment. Other polluting emissions from MSW incineration may include particulate matters (measured in Total Suspended Particulates, TSP); acidic pollutants such as SO_2, NO_x and HCl; and heavy metals, etc. In addition, combustion by-product fly ash often contains dioxins and heavy metals; hence it is considered a major environmental concern and should be properly managed. By reducing these emissions from the demonstration MSW incinerators, the project is expected to have direct environmental benefits.

32. Since the identified physical investments are mainly about enhancement of air pollution control facilities in these existing incinerators, during project preparation an environmental audit and an environmental management plan (EMP) for each incinerator, and an EA executive summary for the project were developed following domestic regulations and Bank safeguards requirements. The World Bank Group Environmental, Health and Safety Guidelines were incorporated into the environmental audit process and EMP where applicable.

33. Other project activities will support enforcement capacity building of regulators, training of incinerator operators, regional planning of MSW disposal, information disclosure, and national level regulatory capacity building for MSW management. Overall, these activities, by improving incinerators' operation, enhancing governments' enforcement and engaging the public, are in line with Stockholm Convention BAT/BEP guidelines. Bank safeguards policies apply to these technical assistance activities as well. Environmental and social safeguards considerations will be fully blended with the scope of work and terms of references for these technical assistance activities.

34. *Environmental audit*. The environmental audit examined regulatory compliance, environmental and social baselines, operating conditions, management of air emissions, wastewater, solid wastes and other environmental, and health and safety issues of the four candidate incinerators in Kunming.

35. *Operating conditions.* The four candidate incinerators in Kunming are relatively new having been put into formal operation in the past few years. Specifically, 1) Wuhua incinerator was built in December 2007 and put into formal operation in July 2008; 2) Dongjiao incinerator was built in March 2009 and put into formal operation in March 2011; 3) Xishan incinerator was built in August 2012 and put into formal operation in June 2013; and 4) Konggang incinerator

was built in June 2011 and put into formal operation in August 2013. Konggang incinerator uses the mass burn (moving grate) technology, while the other three use the circulated fluidized bed (CFB) technology for combustion. After the combustion process, air pollution control facilities are all in place, typically including semi-dry scrubber that targets removal of acidic flue gases, activated carbon injection that removes dioxin and heavy metals, and bag house that collects particulates. All four incinerators generate electricity. According to the technical review during project preparation, the four incinerators are well-designed and incorporate all of the basic hardware elements, design features and operational strategies that are normally required to achieve 0.1 ng TEQ/m^3 (Konggang) or less stringent dioxin emission requirements (the other three incinerators). The four incinerators are also well maintained, have qualified operational staff and have control systems in place that should allow for ready adaptation of an operational and environmental performance enhancement program. However, it is also found that the four incinerators have, to varying degrees, scope for improvements in system control to stabilize process conditions, environmental monitoring, and integrate monitoring of process and environmental parameters for process control and optimization.

36. *Dioxins emission standard*. A comprehensive review of dioxins emission standards for MSW incinerators around the world shows that EU countries, Japan, Beijing, Hong Kong SAR, China, and Taiwan, China all have adopted 0.1 ng TEQ/m^3. The United State standards are about 0.2 and 0.5 ng TEQ/m^3 (after unit conversion) for new and existing MSW incinerators, respectively. China's current national standard, i.e. Standard for Pollution Control on the MSW Incineration (GB18485-2001), was issued in 2001 and stipulates a dioxin emission standard of 1.0ng TEQ/m3. However, in 2008 the Ministry of Environmental Protection (MEP) issued a document stipulating that new MSW incinerators that generate power must meet 0.1 ng TEQ/m^3. Since Konggang and Xishan incinerators' EIAs were approved after the effectiveness of the MEP document, they are required to meet 0.1 ng TEQ/m^3. During the project appraisal, MEP issued updated Standard for Pollution Control on the MSW Incineration (GB18485-2014), which stipulates that all existing MSW incinerators will have to meet 0.1 ng TEQ/m^3 starting from January 1st, 2016, while the current standard (GB18485-2001) will remain effective for existing MSW incinerators until December 31, 2015.

37. *Dioxin emissions.* Dioxin emissions from the four candidate incinerators have been tested at least once a year by accredited monitoring institutes as required by Chinese regulations. The results of these tests are as follows: 1) for Wuhua, 12 tests were carried out as of January 2014. Results range from 0.057 to 0.89, and 9 results were lower than 0.1 ng TEQ/m3; 2) for Dongjiao, 39 tests were carried out as of January 2014. Results ranged from 0.001 ng TEQ/m^3 to 0.187 ng TEQ/m^3, and 36 results were lower than 0.1 ng TEQ/m^3; 2) for Xishan, 21 tests were carried out as of June 2013. Results ranged from 0.00131 ng TEQ/m^3 to 0.078 ng TEQ/m^3 and were all below 0.1 ng TEQ/m^3; and 4) for Konggang, 12 tests were carried out as of end of 2013. Maximum tested level was 0.011ng TEQ/m^3 and all results were below 0.1 ng TEQ/m^3.

38. However, the following need to be taken into account in interpreting these test results. First, during sampling, incineration facilities and air pollution control devices run at normal or optimal conditions; while at other times this may not be the case. This is evident from the fact that some of the dioxin emission test results indicate emissions of 0.001ng TEQ/m^3, which is the

theoretical minimum under perfect conditions and then still only when an over dosage of active carbon is used for removal. For more reliable results, under the project, sampling for dioxin stack tests will be done under normal operating conditions, as required by the relevant Chinese regulation. Furthermore, review of the incinerators' operations showed in three CFB incinerators (Wuhua, Dongjiao and Xishan) a high frequency of fire-pressing and restarts due to below-capacity waste delivery and blockages caused by highly humid waste and extra-large or incombustible objects due to poor MSW segregation at source. According to the incinerators' operators, a typical fire-pressing and restart cycle includes lowering temperature, stopping garbage feed-in, removing of blockage and increasing the furnace temperature. Therefore, these dioxins test results may have not reflected the full picture of dioxin emissions of these incinerators.

39. *Emission levels of other air pollutants*. Other air emissions from the four candidate incinerators were examined by reviewing the results of the environmental acceptance monitoring (which is the precondition of formal operation) and regular inspection monitoring conducted by local environmental protection bureaus and online monitoring records. It should be noted that the EHS Guidelines make reference to EU and US air emission standards for MSW incineration. For some pollutants, either the EU or US standard is more stringent, reflecting different country context, assimilative capacity of the environment, and other factors. The environmental audit found that the EPB inspection monitoring of the four incinerators covered TSP, SO_2, NO_x, Pb, Cd, Hg and HCl; and the results all met domestic standards. In addition : 1) Konggang fully met the EHS Guidelines; 2) Xishan met NO_x, Cd, Hg and HCl of the most stringent standards of the EHS Guidelines, while TSP, SO_2 and Pb did not fully meet the most stringent standards of the EHS Guidelines; 3) Wuhua fully met NO_x, Pb, Hg and HCl, but did not fully meet the most stringent standards in the EHS Guidelines for TSP, SO_2; and 4) Dongjiao fully met NO_x, Pb and Hg, but did not fully meet the most stringent standards in the EHS Guidelines for TSP, SO_2, Cd and HCl. Further, online monitoring covered TSP, CO, NO_x, SO_2, and HCl, and some operating related parameter such as O_2. Online monitoring results were generally consistent with the EPB inspection findings. However, it is noted online monitoring equipment in the four incinerators sometimes did not work well and reported abnormal data indicating maintenance and validation issues. MEP issued Standard for Pollution Control on the MSW Incineration (GB18485-2014) during the project appraisal, which stipulates air emission limits generally in the same levels of EU and US. The new national standards will be effective for existing MSW incinerators starting from January 1st, 2016.

40. *Odor control*. Odor and other non-point source air pollutants comprised of H2S, NH3 and TSP that are mainly from garbage pit in the incinerators. Local communities are sensitive to odor. It is reported that in the past the public complained odor that were potentially from Wuhua and Xishan incinerators. The four incinerators have implemented odor control measures including maintaining negative pressure at garbage pits, odor removal facilities and closure structure to the garbage pits. For Wuhua and Xishan, odor may also have come from other industrial activities surrounding the two incinerators. In the past two years, environmental monitoring of above-mentioned H_2S, NH_3 and TSP at the boundary of the incinerators met domestic standards.

41. *Fly ash and solid waste management*. Fly ash produced in the four candidate incinerators ranged from 5,655t/a to 24,972t/a in 2013. CFB incinerators (i.e. Wuhua, Dongjiao and Xishan) produce more fly ash, accounting for about 6-8% of the MSW incinerated in weight; while mass burn incinerator Konggang produces less, accounting for 3%. Fly ash shall either be sent to local hazardous waste treatment facility, or sent to landfill on the condition that it meets the specifications set at the landfill. Kunming's current hazardous waste treatment facility was put into operation in 2012 and its capacity is inadequate to receive the fly ash produced in these incinerators. Thus in the four incinerators, fly ash is treated through solidification with cement, stone and a chelating agent in order to meet national standards for leaching toxicity. Solidified fly ash is sent to Kunming Xishan Landfills for final disposal. Bottom slag is a non-hazardous solid waste. It is managed separately from fly ash and recycled for producing construction materials. Other solid wastes including garbage and sludge are incinerated.

42. *Wastewater management*. Wastewater streams produced in the incineration plants include leachate from garbage pits, domestic wastewater and other process wastewater. Wuhua has its leachate incinerated or sent to designated leachate treatment facility when the volume of the leachate is too much. Other three incinerators have advanced leachate/wastewater treatment facilities and discharge no wastewater to the environment. Overall these wastewater streams are effectively managed. No noncompliance has been identified in the environmental audit process.

43. *Noise.* Sources of noises in the four incinerators include crushers, draft fan, turbine and other mechanical equipment. Noise control measures taken by the incinerators include sound insulation, damping pad and silencer, etc. Monitoring of noises have been carried out regularly, no noncompliance has been reported.

44. *Risks.* Risk analysis shows that the main potential environmental risk during operation would be: (a) accidental breakdown of waste management system, and (c) fire or explosion. Risk prevention and mitigation measures and emergency response plans have been incorporated into the incinerators' regular management system and in the EMPs. Overall, the risk levels are considered low.

45. *EHS Management System*. Each incinerator has an existing EHS system in place, including an environmental and safety office and dedicated staff, occupational safety regulations, operational monitoring, wastewater and air emission sampling and analysis. These incinerators are also closely monitored and supervised by local environmental protection bureaus (EPBs) whose environmental monitoring stations carry out regular inspections. In addition, online monitoring of air emissions, as mentioned above, is in place and data are transmitted to local EPBs.

46. *Findings and Recommendations.* The environmental audit and technical evaluation carried out during project preparation considered that the incinerators are adequately managed by experienced operators, albeit at uneven levels. Several key issues identified include: 1) all the four incinerators are troubled by high humidity, low heat-value and abnormal size garbage due to poor at-source segregation, which compromise good combustion and/or result in frequent fire-pressing and restart in furnaces. The incinerators' instrumentation and automatic control system may not be adequate to address these challenges. Overall the unsteady operations bring

considerable likelihoods of uncertain emissions; 2) The incinerators' instrumentation and automatic control system need to be enhanced to achieve more stabilized process control; 3) Environmental monitoring seem to be inadequate due to technical and capacity constraints. The online monitoring equipment doesn't work well all time. Some monitoring results seem to be unreliable; 4) Incinerator operators' knowledge of process control, comprehensive application of BAT/BEP and environmental compliance need to be further enhanced. In conclusion, the results of environmental audit carried out during project preparation prove the necessity of a comprehensive operating and environmental performance audit in the first year of project implementation.

47. All draft EAs and EMPs were made available locally on March 10, 2014, and in the World Bank InfoShop on March 25, 2014, and as such, are accessible to the general public. The subsequently updated EAs and EMPs were disclosed in the World Bank Infoshop on August 15, 2014.

Social Safeguards

48. The social impacts of the proposed project would primarily be mainly positive. The primary project beneficiaries will be the local environmental protection bureaus in two cities of Kunming and Ningbo and local residents in four districts of Kunming. They will benefit from strengthened capacity for solid waste management and reduced exposure to dioxin emissions from MSW incinerators.

49. A social assessment was carried out through extensive consultation with various stakeholders, a questionnaire survey with local residents, a desk review, and participator observations. The assessment aimed at:

(a) Identifying the primary stakeholders, and their interests and needs, and their potential impacts on the project and environment;

(b) Learning the potential positive and negative impacts, and social risks of the project;

(c) Learning public perceptions and ideas of information disclosure on the project and air emissions, identifying the primary stakeholders' needs for information disclosure and public participation, and developing strategies suited to local culture and customs;

(d) Proposing a social management plan that optimizes the project design, improves information disclosure and promotes public participation through extensive consultation, thereby evading risks and promoting the realization of the project objectives.

50. Topics discussed with stakeholders ranged from waste management in general, such as service coverage and waste management fees, to incineration in particular, including the stakeholders' perceptions of health and other impacts of incineration, as well pollution control technologies that may be supported by the project. The findings of the social assessment reinforced the fact that public reactions against dioxin emissions from MSW incinerators have

become more common in China's large cities in recent years, and there is also significant lack of confidence in the information shared with the public on these emissions.

51. The social assessment found that women declared to know less than men about hazardous emissions from incinerators, but women expressed more concern about incinerators' impact on health and quality of life. Women were also less aware than men of environmental information disclosed by incinerators and less satisfied with the information disclosed. Women were significantly more interested in information on health impacts than men. Finally, women differed from men in their preferred mode of access to information. These differences have been reflected in the information disclosure plan in Kunming. Women's and men's level of knowledge about information disclosure on incinerator environmental impacts will be tracked through annual households surveys in the communities living near Kunming's five incinerators. The target of the project is that in these communities 50% of each sub-group surveyed are aware of the availability of such information (Annex 1).

52. The main outcome of the social assessment was a public information disclosure and public awareness raising strategy, which have been fully incorporated in project design (see Annex 3) and results indicators. Notably, during the project, local communities' awareness of information disclosure of incinerators pollutant emissions will be monitored, in a gender-segregated way, as part of the Project Results Framework (Annex 1).

53. Land acquisition for purposes of construction of four incinerators in Kunming City took place prior to this project. It was completed without anticipation to the proposed project. Nevertheless, a retroactive due diligence review of the land acquisition was carried out. The review included a comprehensive review of the land acquisition and resettlement processes of the Xishan and Konggang incinerators and concluded that these processes complied with the Land Administration Law of the People's Republic of China, and the regulations and policies of Yunnan Province and Kunming City on resettlement. Surveys of affected households indicated that all sampled households had enhanced incomes and expenditures after compensation and resettlement, reflecting that the affected households' incomes and living standards were restored and improved effectively. All affected persons interviewed were satisfied with the compensation and process.

54. In the case of Dongjiao and Wuhua, land acquisition was completed 16 and 8 years ago, respectively. While, due to the time that had elapsed, it was impossible to carry out as detailed a review as in the case of Xishan and Konggang, key information on the impacts of land acquisition in terms of type, area, number of affected people (Wuhua) as well as on compensation payments made (Wuhua) was collected. In addition, in the case of Wuhua, a few affected persons attended the focus group discussions of the project social assessment. These individuals said that since most of the acquired land was wasteland, their production and livelihoods were not affected, and some local residents stated that this plant had improved the local environment and their quality of life to some extent. No complaints were voiced.

55. Overall, the due diligence review concluded that although the land acquisition was implemented mainly followed the relevant government policies and regulations, it was consistent

with the requirements of the Bank Policy on Involuntary Resettlement OP 4.12. The review did not find any pending issues on land acquisition carried out prior to the Project.

56. No new land acquisition is envisaged under the project as there is no expansion of any of the existing incinerators.

57. There are no ethnic minority communities in the project area.

Monitoring & Evaluation

58. FECO PMO will have overall responsibility for project monitoring and evaluation (M&E). It will gauge progress in national level activities and receive M&E reports from Yunnan PMO and Ningbo PMO, on their respective activities. FECO PMO will prepare semi-annual implementation progress reports, including M&E. Annual results indicators will be reported in the second semi-annual report each year. These reports will be mainly in tabular format following Annex 1; but, they will also include discussions of reasons for any delays and propose corrective actions. The reports will be reviewed together with the Bank supervision task team to assess the need for any changes in the course of project implementation.

59. Yunnan PMO and Ningbo PMO will be responsible for collecting M&E data related to their respective activities, as detailed in Annex 1 and Table 1 above, and submit semi-annual reports to FECO PMO.

Appendix 1. Public Information Disclosure and Awareness Raising Plan

Objectives

Through the implementation of information disclosure and public awareness improvement activities, provide the public with information channels to know about the project, and disseminate to the public about: (1) project information; and (2) MSW incineration management and technology related health knowledge, to improve public awareness.

1. Necessity of Information Disclosure and Public Awareness Improvement

According to the *Social Impact Assessment Report*, information disclosure and public participation were inadequate during the construction stage of the four waste incineration power plants, which resulted in a low awareness to waste incineration power plants and hazardous emissions from waste incineration. Residents' low awareness played as the main reason for their attitude of exclusion and revulsion to waste incineration.

To achieve expected project objectives and benefits, social assessment institute and project main stakeholders have carried out sufficient discussions, and based on field investigation and data analysis, conclusions reveals that similar waste incineration projects are likely to bring negative demonstration effects and the public are likely to have psychological presupposition and preconceptions, which may result in the risk of public's protesting against the project negatively or mass incidents on waste incineration.

Therefore, improving information disclosure and public participation and awareness to waste management and hazardous emissions from waste incineration must be enforced.

2. Contents and Activities

Establishing an Internet Platform for the Project

In view of residents' trust to the information disclosed by government channels, special columns will be set on the official websites of Yunnan Environmental Protection Department (YEPD) and Kunming Urban Management Bureau (KUMB) for the GEF project to publicize the project objectives and contents, project progress, waste management, waste incineration, dioxin knowledge, and health risks as well as the GEF project dynamics and achievements, to enhance the public and potentially impacted residents' understanding and knowledge to the project.

Publicizing Operation Data of the Four Waste Incineration Power Plants

An LED display screen will be put up by each plant provides to publicize working conditions. Daily average values of operation parameters are displayed in the special column for the project on the YEPD website.

Publicizing Real-time Monitoring Data of the Four Waste Incineration Power Plants

Daily average values of real-time monitoring data are displayed in the special column for the project on the YEPD website. Refer to the following table for details.

Publicizing Dioxin Monitoring Results

It is difficult to test dioxin and professional works are required. The monitoring results provided by professional organizations are displayed in the special column for the project on the YEPD website.

Carrying out Education Activities for Waste Incineration

By publicizing the project, basic knowledge of waste incineration and persistent organic pollution is popularized so the public have a better understanding and improved consciousness about MSW classification. This also develops citizens' sense of supervision, thereby enhancing the government's management of waste.

Education activities can correct people's wrong ideas and affect individual behaviors. Publicity plans are prepared based on this principle.

- *Organize education activities.* Design and produce the dissemination products and carry out publicity activities in project potentially-affected communities.
- *Use media to carry out publicity activities.* Use media to further publicize waste incineration and enhance public *awareness*.
- *Carry out community activities and interaction activities to publicize experiences, and display photos.*

Carrying out Interaction Activities Between the Waste Incineration Power Plants andCitizens

A platform for interaction activities between the waste incineration power plants and citizens is important for the public to learn about waste incineration.

Different platforms are required for different citizen groups. Use the existing ecological education base for the youth to occasionally organize students to visit plants and carry out education activities. Offer professional explanation and brochures to allow the youth learn about waste incineration knowledge. In addition, invite village and community residents to visit plants and exchange ideas. Provide knowledge about waste management, waste incineration, dioxin, and health risks and brochures to address residents' questions. Listen to residents' ideas.

In interaction activities, pay attention to vulnerable groups such as senior citizens, women, children, and the disabled. Provide professional explanations and brochures to visiting environmentalists, social groups, and NGO and address their questions.

Table 1 Real-time monitoring parameters for waste incineration plants

Wuhua	Xishan	Dongjiao	Konggang
· Smoke dust · Velocity of flue gas · SO_2 · NOx · O_2 content · CO · Flue gas temperature · Standard state flow	· Smoke dust · Velocity of flue gas · Flue gas pressure · SO_2 · NOx · O_2 content · CO · HF · Flue gas temperature · Standard state flow	· Smoke dust · Velocity of flue gas · SO_2 · NOx · O_2 content · CO · Standard state flow	· Smoke dust · Velocity of flue gas · Flue gas pressure · SO_2 · NOx · CO · HF · Flue gas temperature · Standard state flow

Establishing Complaint and Grievance Channels

If the waste incineration power plants generate odor and sewage that affect the health of nearby residents during the operation of the waste incineration power plants, the residents may express their grievance through the following procedures below:

Phase 1: Report to community/village committees in writing or orally. Then, the community/village committees communicate with the waste incineration power plants. The

community/village committees and waste incineration power plants shall solve the problem within two weeks.

Phase 2: If the residents are not satisfied with the results in phase 1, they can report the problem to environmental protection bureaus (EPBs) at district level in writing or orally. The EPBs shall make decision regarding the grievance within two weeks.

Phase 3: If the residents are not satisfied with the results in phase 2, they can report the problem to municipal EPB in writing or orally. The municipal EPB shall make decision regarding the grievance within two weeks.

Phase 4: If the residents are not satisfied with the handling results in phase 3, they can institute proceedings in the local people's court according to the Civil Procedure Law of the People's Republic of China. It will be subject to the court judgment.

Currently, Kunming municipal and district EPBs have set up the Director-general mailboxes and complaints hotline. The 10th of each month is the Open Day for the on-duty heads to meet with visiting citizens.

The Grievance Redress Mechanism thus established will cover grievances concerning the deficient performance or coverage of Project activities, including any grievances related to legacy issues for land acquired for the construction of four MSW incineration plants in Kunming City.

Table 2. Grievance contacts

Unit	Contact	Telephone
Project Office		0871-64166316
Kunming Urban Management Bureau	Hao Ping	0871-63190771
Waste Incineration Power Plant in Wuhua	Plant office	0871-68307396
Dongjiao Waste Incineration Power Plant	Plant office	0871-67396512
Xishan District Waste Incineration Power Plant	Plant office	0871-68599896
Konggang Incineration Power Plant	Plant office	0871-68017385

Table 3 Project information to be publicized

Contents	Target	Channel	Frequency	Implementation Unit
Information Publicity				
Project contents and objectives	· Public and residents in potentially-affected areas	· Website of Yunnan Environmental Protection Department · Bulletin boards in communities	· After the project assessment	· Information Center of Department of Environment of Yunnan Province · Project Management Office · Village/community committees
Working conditions publicity	· The public	· Website of the Kunming Urban Management Bureau · LED display	· Daily Average Value	· Kunming Urban Management Bureau · Demonstration enterprises
Real-time monitoring data	· The public	· Website of Yunnan Environmental Protection Department	· Daily Average Value	· Information Center of Department of Environment of Yunnan Province
Dioxin monitoring data publicity	· The public	· Website of Yunnan Environmental Protection Department	· Dioxin monitoring data publicity: 1-2 times per year	· Information Center of Department of Environment of Yunnan Province · Project Management Office
Carry out publicity activities to improve public awareness.				
Popularize knowledge about waste management, waste incineration, dioxin, and health risks, and government's supervision on wastes in a generally straightforward manner.	·Public and residents in potentially-affected areas, particularly vulnerable groups such as senior citizens, women, children, and the disabled	· Brochures · Bulletin boards in communities · Website of Yunnan Environmental Protection Department · Media · Activities organized by waste incineration power plants	· Occasional	· Project Management Office · Information Center of Department of Environment of Yunnan Province · Municipal environmental protection bureau · Kunming Urban Management Bureau · Waste Incineration Power Plants Village/community committees
Interaction activities between waste incineration power plants and residents	· Public and residents in potentially-affected areas, particularly vulnerable groups such as senior citizens, women, children, and the disabled	· Residents visit waste incineration power plants. · Resident representatives communicate with plant representatives.	· 1-2 times per year	· Project Management Office · Waste Incineration Power Plants · Village/community committees

3. Monitoring Indexes

S/N	Contents and Activities	Monitoring Index
1	GEF project information (project contents, objectives, and progress) publicity	· Bulletin boards in communities nearby waste incineration power plants · Website of Yunnan Environmental Protection Department
2	Working conditions publicity	· Daily monitoring data displayed on the website of the Kunming Urban Management Bureau · Real-time monitoring data displayed on LED displays
3	Real-time monitoring data publicity	· Daily monitoring data displayed on the website of the Yunnan Environmental Protection Department
4	Dioxin monitoring data	· Dioxin monitoring data displayed on the website of the Yunnan Environmental Protection Department
5	Education activities for waste incineration	· Publicity materials · Media Activity records
6	Interaction activities between the waste incineration power plants and citizens	· Times of public visiting to plants · Number of meetings between resident representatives and plant representatives · Meeting records · 30% of the all the people visiting plants and participating in meetings are women.

Annex 4: Operational Risk Assessment Framework (ORAF)

China: CH GEF Municipal Solid Waste Management Project (P126832)

Project Stakeholder Risks						
Stakeholder Risk	**Rating**	**Substantial**				
Risk Description: The Bank's involvement in the MSW sector may be misinterpreted as support to waste incineration over other disposal methods in general rather than as an effort to improve existing incinerators' environmental performance.	Risk Management: The project's aim to reduce the MSW incineration's negative environmental impact is clearly elaborated in the project documents and will be emphasized in project public awareness raising activities. The PAD makes reference to the recent Development research Center of the State Council and World Bank joint publication "Urban China Toward Efficient, Inclusive, and Sustainable Urbanization", which calls for improved environmental management of waste disposal, in general and waste incineration, in particular.					
	Resp: Client	Status: In Progress	Stage: Both	Recurrent ✔	Due Date:	Frequency
Implementing Agency (IA) Risks (including Fiduciary Risks)						
Capacity	**Rating**	**Substantial**				
Risk Description: The implementing agency FECO's limited technical capacity in MSW management and the limited project management capacity in Ningbo, one of the demonstration cities, may slow down project implementation. The decentralized nature of project implementation may challenge FECO PMO's ability to consistently oversee project management actions, including fiduciary activities, by the PMOs in Ningbo and Kunming.	Risk Management: FECO will retain the skilled, responsive and cooperative FECO project team that ably managed the last phase of project preparation and will maintain strong management oversight in day-to-day project management. FECO will also need to retain the expert advisers who in the latter part of project preparation provided valuable technical contributions and will be needed for the timely resolution of technical issues during project implementation. MOHURD will provide technical oversight to the activities that are under its mandate and in which FECO has limited technical competence. Other municipal agencies and FECO will assist the Ningbo PMO in project management. The Bank team will carry out integrated financial management, procurement and technical reviews during project supervision missions and will provide will provide continuous procurement training during project implementation, including on good contract management practices and the Anti-Corruption Guidelines, to all PMOs.					
	Resp: Client	Status: Completed	Stage: Both	Recurrent ✔	Due Date:	Frequency
Governance	**Rating**	**Moderate**				
Risk Description: Agencies other than FECO, which play an important role in MSW management but do not control project fund allocation, may have insufficient ownership towards the project and thus not implement activities within their mandate in an efficient manner. Lack of coordination among stakeholders may affect timely project implementation.	Risk Management: MOHURD has committed to providing technical oversight for the activities that it proposed and are under its mandate. This commitment is documented in the grant agreement. The responsibilities of each stakeholder have been clarified and documented in the PAD.					
	Resp: Both	Status: In Progress	Stage: Both	Recurrent ✔	Due Date:	Frequency
Project Risks						
Design	**Rating**	**Moderate**				

Risk Description: Lack of adequate information on incinerator operations and of reliable data on past dioxin emissions hamper design of effective BAT/BEP measures to be supported by the project.	Risk Management: The two-phase approach agreed with FECO and Kunming City to the design of the operational improvement program will allow collection of detailed operational and emission data, on which design of the operational improvement programs will be based. However, such data collection will still require commitment of the Kunming City and district level EPBs and Kunming UMB, which face capacity limitations.					
	Resp: Client	Status: In Progress	Stage: Implementation	Recurrent ✔	Due Date:	Frequency
Social and Environmental	**Rating**	**Moderate**				
Risk Description: Environment: MSW incineration facilities produce polluting air emissions that may include carbon dioxide, CO, NOx, SO2, PM, ammonia, VOCs, dioxins/furans, heavy metals and sulfides. etc. Fly ash is also generated from flue gas treatment, which is considered hazardous waste. In addition, MSW incinerators produce other waste streams such as wastewater. These waste streams, particular the air emissions and fly ash, if not well managed, have the potential to pose significant environmental and public health impacts. Social: There is significant lack of confidence in the information shared with the public on these emissions.	Risk Management: Each participating incineration plant has prepared an environmental audit/EMP in accordance with domestic EA regulations and Bank safeguard policies. The EAs/EMPs address relevant EHS issues. The EMPs will be updated following the first year operational and environmental performance audits and incorporated into the operational improvements programs of demonstration incinerators. Emission data will be disclosed to the public through the websites of local environmental protection bureaus and urban management bureaus. Social: To enhance the transparency and accessibility of information on dioxin and other pollutant emissions from incinerators remains a big social challenge of the project. An information disclosure plan and a grievance mechanism are established on the basis of the findings of the Social Assessment study on community members' attitudes and expectations.					
	Resp: Client	Status: In Progress	Stage: Both	Recurrent ✔	Due Date:	Frequency
Program and Donor	**Rating**	**Low**				
Risk Description: There are no other donors supporting programs to improve the environmental performance of *existing* MSW incinerators.	Risk Management: No actions are necessary.					
	Resp:	Status:	Stage:	Recurrent	Due Date:	Frequency
Delivery Monitoring and Sustainability	**Rating**	**Substantial**				
Risk Description: Sustainability of BAT/BEP in the selected incinerators will likely be compromised due to: 1) Inadequate monitoring and enforcement capacity in Kunming municipal and district EPBs and municipal UMB may endanger the sustainability of the project demonstrated BAT/BEP. 2) Financial weaknesses of the incinerators. The weak financial status of the candidate demonstration incinerators may limit their ability to cover the recurrent costs associated with improved operations and environmental management.	Risk Management: The project will support a number of capacity building measures for monitoring and enforcement under Component 1B. However, limited inspection staff capacity in terms of educational level and numbers, over which the project has no influence, will continue to limit enforcement capacity beyond the project. Regarding incinerator financial viability, Kunming City will work with the incinerators to devise a financial viability action plan. The plan would include, inter alia: (i) all expenditures estimated to be incurred by the participating incinerators during the five year period, including debt service and capital expenditures; (ii) the estimated resources available to the participating incinerators, including revenues from their own operations, tipping fees, borrowings and equity; and (iii) proposed actions to ensure the continued financial viability of the participating incinerators. Furthermore, financial viability and commitment to implementing an operational improvement plan will be among the selection criteria for demonstration incinerators. If more than one of Kunming's four candidate incinerators fail to meet the said criteria the project will seek demonstration incinerators in other cities or part of the project will be canceled.					
	Resp: Client	Status: In Progress	Stage: Implementation	Recurrent ✔	Due Date:	Frequency

Overall Risk

Implementation Risk Rating: **Substantial**

Risk Description:
The risks in Stakeholder, Capacity, Monitoring and Sustainability identified above are rated substantial, which makes the overall implementation risk substantial. These risks will be addressed by the described mitigation measures during project implementation. They will also be closely monitored, updated and managed through continuous implementation review and support by the task team.

Annex 5: Implementation Support Plan

China: Municipal Solid Waste Management Project

Strategy and Approach for Implementation Support

1. The Implementation Support Plan takes into the account the project's technical capacity building focus, safeguards needs, and moderate risks with regards to FM and procurement.

2. Implementation support will focus on

(a) *Technical capacity building*. International expertise on waste incineration operations, emission control, and regulation of incinerators will be deployed to support counterparts at the national and demonstration city levels. In particular, the first year's operational and environmental audits and the development of operational improvement plans will require close attention as they will be the foundation for the ensuing project activities.

(b) *Social and environmental safeguards*. The project's subject matter, MSW incineration, is a contentious issue in China and around the world. Therefore, it will be important to adequately convey the project's objective to local and global stakeholders that the project's objective is improve operational and regulatory capacity such that dioxin emissions will be kept at globally acceptable levels in a consistent manner. Similarly it will be important that all environmental impacts of the demonstration incinerators are within national limits. Therefore, social and environmental safeguards specialists will be an integral part of the implementation support team assisting the counterpart in these areas.

(c) *Financial Management/Procurement*. FM and procurement capacity assessments have shown lack of experience with Bank fiduciary practices. Initial FM supervision will focus on counterpart staff training and compliance with the Bank's FM and disbursement related requirements. The FM risk rating will be evaluated regularly and inform the supervision approach. With regard to procurement, prior review supervision will be carried out. Procurement post reviews will be carried out by the Bank and/or external auditors every 12 months. The procurement post review sampling ratio will be one out of 15 contracts.

Integrated fiduciary and technical reviews will be carried out by the Bank during supervision missions to review procurement, contract management, implementation progress and financial management under the project. Furtherermore, the team will provide continuous procurement training during project implementation, including on good contract management practices and the Anti-Corruption Guidelines.

Project Implementation Support Input Requirements

3. The first two years in project implementation will be crucial for the project's success, since during this period critical operational and environmental performance audits will be carried out, operations improvement programs will be developed, key IT hardware and software will be put in place for continuous monitoring, public awareness raising and monitoring programs will be initiated, and incinerators' eligibility for receiving investment support will be determined.

4. Several key task team members are based in the Beijing office and will be able to provide timely and efficient implementation support to the client. In addition the Bank team will conduct semi-annual implementation support missions, including field visits to review progress and to address and resolve any issues that may arise. The task team will comprise a combination of technical, environmental, social and fiduciary experts to be able to address the different aspects of the operation.

Project Implementation Support Input Requirements

Time	Focus	Skill Needed	Resource Estimate /Year
First 24 months	Task team leadership	Task team leader	6 SW/person and 2 trips
		Co-TTL	4 SW/person and 2 trips
	MSW Incinerator operations and regulations	MSW management and regulation specialist	6 SW and 2 trips
	FM & procurement	FM & Procurement specialists	4 SW and 2 trips / specialist
	Safeguards	Social development and environmental specialists	4 SW and 2 trip / specialist
	Environmental monitoring	IT specialist	2 SW and 1 trip
	Coordination with Ningbo loan project	Urban specialist	1 SW and 1 trip
25 – 60 months	Team and task leadership	Task team leaders	4 SW and 2 trips/staff
	MSW Incinerator operations and regulations	MSW management and regulation specialist	6 SW and 2 trips /year
	FM & procurement	FM & Procurement specialists	3 SW and 1 trip / specialist
	Safeguards	Social development and environmental specialists	3 SW and 1 trip / specialist

SW: staff week

Annex 6: Financial and Economic Analysis

China: Municipal Solid Waste Management Project

Financial Analysis

1. This annex presents an analysis of two questions for each of the four proposed demonstration incinerators:

(i) What is the general financial health of the enterprise?

(ii) Is the enterprise able to provide the counterpart funding needed for the project investments?

2. Another important issue, namely (iii) the enterprise's ability to cover the recurrent costs associated with operational practices that are consistent with BAT and BEP was not addressed due to incomplete information on current operational practices. Such operational requirements will be designed and the associated recurrent costs will be estimated based on the findings of the first-year operational and environmental performance audits. At that time each candidate plant's financial ability to cover these costs in a consistent manner will be analyzed.

3. Arrears in the payment to the incinerators by the districts of agreed tipping fees have a bearing on all three questions above and are incorporated in the analysis. Appendix 1 discusses the current state of the arrears and of agreements reached among municipal and district authorities and the incinerators to settle them.

4. This analysis reflects the four candidate incinerators' financial status as of early 2014. A similar analysis will be carried out at the end of the operational and environmental performance audits to determine whether they quality to participate in the operational enhancement program.

General MSW Management Situation in Kunming Affecting the Incinerators' Finances

5. *Overdesign of incineration capacity*. The planning of incinerator capacity was based on the assumption that as of 2010 4,850 tons per day of waste would be available from Kunming's population of 4.85 million and that by 2015, this population would rise to 5.22 million generating 5,220 tons of waste per day. These population estimates included urban as well as rural areas, in anticipation of a significant influx to the Kunming metropolitan area of rural dwellers from other parts of Yunnan. The established daily incineration capacity is currently 4,600 tons and will reach 5,300 tons by the end of 2014 when the fifth incinerator is expected to be fully operational. However, a large amount of waste generated in rural areas has not been transferred to the incinerators but disposed on nearby dumpsites, due to incomplete waste collection coverage in rural areas, long distances, and unaffordability of waste management fees to rural communities.

6. The direct consequence of the excess capacity has been that incinerators have not been provided with the amount of waste that was included in their agreements with UMB. Specifically, Dongjiao had been guaranteed 1,600 tons per day, and 584,000 tons per year,

Xishan and Wuhua no less than 800 tons per day, and Konggang 600 tons per day for the first three years of operation, and 800 t/d for the 4th and 5th years, 1,000 t/d after that.

7. *Inability to collect waste management fee.* Of the waste management fee of Yuan 180 /ton, Yuan 90/ton is for waste disposal. However, until 2013, the districts had great difficulty collecting these fees. In 2013, they started to collect this fee in connection with the water tariff. This situation led to great arrears in the payment of tipping fees to incinerators, as discussed in the appendix to this annex.

Dongjiao (Kunming Zhongdian Waste to Energy Co. Ltd)

8. The Dongjiao plant was put into operation in January 2010 under a 30-year concessional build-operate-transfer contract between the government and an investor, i.e. Kunming Zhongdian Environmental Protection Power Co., Ltd. The plant has four sets of 550 tons per day fluidized bed combustion units with a total daily processing capacity of 1,600 tons.

Dongjiao - General financial health

9. Dongjiao was profitable in both 2012 and 2013; however, its operating margin fell significantly in this period because 40,000 tons of the waste it had received previously[24] was diverted to the newly established Konggang incinerator and it agreed to a reduction in the tipping fee from Yuan 90/ton to an average of Yuan 60 / ton. This led to a drop in revenues, while the operating costs remained nearly constant.

10. Dongjiao is owed USD 6.1 million in tipping fees from operations through August 2013.

Dongjiao – Ability to raise counterpart funds

11. The proposed counterpart investments total USD 6.95 million. Its cash reserves are limited; therefore, to cover the counterpart costs, it will need to complement them with transfers from its parent company and with a bank loan. The parent company has expressed willingness to provide the funds. Dongjiao has a strong debt repayment capacity, as indicated by its acceptable liability to asset ratio. As such, the company should be able to obtain the needed bank loan. In summary, it is concluded that the enterprise would be able to raise the needed counterpart funds.

12. Repayment of the tipping fee arrears in 2014 and 2015 will increase the enterprise's cash holdings and therefore reduce the amount it needs to borrow. It will also improve the company's ability to borrow, as its short-term debt payment capacity indicators will improve.

Konggang (Kunming Chonggang Waste to Energy Co. Ltd.)

13. Konggang began operations in 2012 under a 30 year BOT contract with KUMB. It has three 500 tons per day mass burning grates, resulting in 1,000 tons per day total capacity.

[24] In 2012, Dongjiao received 540,000 tons.

Konggang - General financial health

14. In its first year of operation, 2013, Konggang's operating profit ratio was limited and its return on net assets low because it operated on average at 600 tons per day compared to its capacity of 1,000 tons per day. The company is located in the newly developed, sparsely populated new airport area, where waste generation has been lower than earlier projections. The company's prospects will depend on its ability to identify new feedstock sources.

15. The tipping fee arrears owned to the company are USD 0.69 million. The agreed repayment is negligible and will not contribute to the company's financial status.

Konggang – Ability to raise counterpart funds

16. The total amount required for the proposed counterpart investments is USD 0.67 million. The company's cash reserves would be sufficient to cover this cost.

Wuhua (Kunming Xin Xingze Environmental Resource Industry Company Ltd.)

17. Wuhua began operations in January 2008 under a 30-year BOT agreement with the Kunming Urban Management Bureau. The plant has three 400 tons / day fluidized bed incinerators with a total daily processing capacity of 1,200 tons.

Wuhua - General financial health

18. Wuhua's revenues and profits increased substantially from 2012, when it underwent significant renovations for six months to reduce its coal usage, to 2013. The said renovation increased its profit generation capacity.

19. Wuhua is owed a total of USD 9.7million in tipping fees for its services through August 2013, which made up a substantial portion of its accounts receivable in 2013.

Wuhua – Ability to raise counterpart funds

20. Wuhua would cover the cost of installation, designs and other miscellaneous items related to the GEF funded equipment, estimated at USD 1.1 million.

21. Wuhua plans to use either its cash reserves or a loan from the parent company or a combination thereof to cover the counterpart costs. While its cash reserves are low, its cash ratio of primary business ratio was highly satisfactory. The agreed payment of tipping fee arrears will improve the company's cash flows and increase its cash reserves. Therefore it is believed that the company can cover these costs.

Xishan (Yunnan Green Energy Co. Ltd.)

22. Xishan began operations in June 2011 under a 30-year BOT agreement with the Kunming Urban Management Bureau. The plant has three 400 tons / day fluidized bed combustion units with a total daily processing capacity of 800 tons. It has two turbines of 12MWs each.

Xishan - General financial health

23. The company has operated below its capacity. In June 2013 the daily amount treated was 650tons, while in 2012 the amount was in the neighborhood of 500 tons. Furthermore, the tipping fee was Yuan 45/ton, as opposed to the regular Yuan 90 / ton. It has also received a low feed-in tariff of Yuan 0.46/KHh. Consequently, the company has operating losses in both 2012 and 2013. Cash flows were also negatively impacted by the delayed payment of the subsidy portion of the feed-in tariff for power generated.

24. The company has received sizeable loans from its parent company and is expected to receive another loan in 2014.

25. To turn into a profit making enterprise, Xishan intends to negotiate an increase of the tipping fee to Yuan 90/ton to increase its revenues. The company also plans to apply for the feed-in tariff subsidy of Yuan 0.1894/kWh for the electricity generated since 2012. This should generate additional revenues. It has also arranged to receive additional 100 tons per day each from two counties.

26. Tipping fee arrears owned to Xishan is about USD 0.3 million, which is much lower than the amount owed to the other three companies. The agreed repayment schedule foresees a negligible amount for Xishan and will not contribute to its financial status.

Xishan – Ability to raise counterpart funds

27. The proposed counterpart investments, namely design, installation and other miscellaneous items related to the GEF funded equipment would cost USD 0.6 million. Xishan's cash reserves are not large enough to cover this cost. Given its high debt to assets ratio, it would also not be able to obtain a bank loan. However, the parent company has indicated willingness to lend Xishan the needed resources.

Appendix 1. Tipping Fee Arrears

28. Seven districts of Kunming Municipality that use the four incinerators to dispose of their household solid waste accumulated a total of USD 16.8 million in tipping fee arrears through August 2013. These amounts were verified by the incinerators in December 2013. The largest amount is owed to Wuhua, USD 9.7 million, followed by Dongjiao USD 6.1 million. The arrears owned to Xishan and Konggang are relatively small. A key factor leading to these arrears was the districts' inability to collect waste management fees from households.

29. Kunming Municipal Government agreed to settle the arrears as it recognizes their impact on the financial health of the incinerators and their ability to invest in improved environmental management, including dioxin emission reduction. In December 2013, it was agreed that the arrears originating from before July 1, 2012 would be settled by the district urban management bureaus.

30. For the arrears accumulated between July 1, 2012 and August, 2013, it was agreed that the Kunming Municipal Finance Bureau and the finance bureaus of the seven districts whose waste the incinerators dispose would share repayment responsibility in a 18:82 ratio. However, no agreement has been reached about a timetable for this repayment.

31. The breakdown of arrears by period of accumulation per incinerator and the agreed payment schedule by district UMB of arrear from prior to July 1, 2012 has been appraised by the Bank and is included in Project Files.

Current Payment of Tipping Fees

32. In addition to the repayment of past arrears, it will be important for the sustainability of the project that current and future tipping fees are paid in a timely manner. According to the Kunming Urban Management Bureau (KUMB), districts have been able to raise the collection rate of household waste management fees in 2013 by linking it with the water bill. Specifically, of the total potential household fees designated for incineration of Yuan 230million, in 2013 Yuan 160-170 million (70%-74%) was collected. KUMB predicts that the collection rate will increase to Yuan 200 million (87%). This is a positive development; however, the total collected amount remains short of the total amount of tipping fees needed to pay the incinerators completely for their services.

Economic Analysis

1. According to the World Health Organization (WHO), short-term exposure to high levels of dioxins and dioxin-like substances in occupational settings or following industrial accidents may cause skin lesions. Longer-term environmental exposure causes a range of toxicity, including immunotoxicity, developmental and neurodevelopmental effects, and effects on thyroid and steroid hormones and reproductive function. Fetuses and newborns are considered most sensitive. In 1997 WHO's International Agency for Research on Cancer classified the most potent dioxin, 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) as carcinogenic to humans. The main pathways of exposure are through air and through consumption of meat from animals that fed on plants with dioxin containing sediments.

2. Establishing a causal relationship between dioxin exposure and elevated incidence of cancer remains a challenge due to methodological difficulties regarding, among others, adequate measurement of exposure and possible confounding factors (Giusti, 2009). While also impacted by similar issues, two epidemiological studies in France and Italy provide evidence for a link between high dioxin emissions and the incidence of non-Hodgkin's lymphoma and soft tissue sarcomas around MSW incinerators. Both studies cover periods before the EU dioxin emission limit of 0.1 ng I-TEQ/Nm3 was adopted and are therefore relevant to the project area. Specifically, the investigation around the Besançon incinerator (Viel et al., 2000), and around 13 other French incinerators (Viel et al. 2008) found a modest association between non-Hodgkin's lymphoma and exposure (based on residence and soil levels of dioxins) to dioxins emitted by municipal solid waste incinerators. Zambon et al. (2007) found that exposure to dioxin-like substances released from 33 sources of airborne dioxin, including incinerators of MSW, industrial waste, and medical waste, and a range of other industrial sources including an oil refinery in the Province of Venice was responsible for an increased risk of developing sarcoma. The research showed a significant increase in the risk of sarcoma, correlated both with the level and the length of environmental modelled exposure to dioxin-like substances. The risk excess was also found to be evident in females, and, for both sexes taken together, for cancers of the connective and other soft tissue (Zambon et al., 2007).

3. The economic justification for this project is driven by the benefits of reducing the severe probable health impacts of releasing toxic chemicals, including dioxins and furans, into the environment as a result of improper management of solid waste incinerators. Not only are these chemicals a risk to people in the immediate vicinity of the incinerators at the time of release, but they are known to be persistent in the environment for long periods of time and can be disbursed widely by wind and along the food chain. Clean-up after the fact is expensive or impossible. Developed countries have recognized the high cost of health and environmental impacts from dioxin and furan releases, and have developed stringent emission standards for their emission from MSW incinerators. These standards are reflected in the Stockholm Convention BAT and BEP. They are a balance between minimizing the health and environmental risk of emissions release and the cost and technical feasibility of reducing these emissions. As a signatory of the Stockholm Convention, China is committed to minimizing dioxin and furan emissions from its

growing MSW incineration sector and seeks to demonstrate the BAT and BEP suggested by the Stockholm Convention at Kunming's incinerators. Since this is a pilot project to demonstrate, test and adapt these BAT and BEP to local conditions; and adaptation of these solutions will be site specific; no ex-ante cost analysis of the specific technical options was warranted. Cost effectiveness will be one factor considered when developing the operational improvement program at each site during the first year of the project.

4. There are approximately 25,000 people living in close vicinity of these demonstration incinerators who would directly benefit from lower dioxin exposure to dioxins and furans. Considering the total project cost of USD 32.9 million, the per-person cost is about USD 1,300. Since this is a pilot to test new approaches, there is a high learning and training cost included in this calculation. The cost per beneficiary of introducing better MEP and BEP per beneficiary once these approaches mainstreamed and scaled up would be substantially less. In fact, the number of beneficiaries is much larger since dioxins and furans, like other POPs, persist in the nature for decades and travel far from their sources. This project would help identify cost effective approaches to reducing exposure.

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Annex 7: Technical Assessment

China: Municipal Solid Waste Management Project

1. As part of project appraisal a first-line assessment of operational management was carried among Kunming's four candidate incinerators for participation in the operational improvement program. The purpose of the assessment was to review operational and process control management practices at the said incinerators. The annex first documents the observations made at each incinerator and then provides overall conclusions and recommendations.

Observations at Individual Incinerators

XiShan

(Fluidized bed incinerators, 3 x 400t/d installed capacity, official operation since June 2013)

2. The plant receives about 700t/d of household waste. After reduction (taking out lumpy waste pieces, particularly construction waste; drainage of leachate) the remainder of some 550t/d is fed to one incinerator line. The other two lines were not operating during the mission, which is quite common due to regular shortage of feedstock. The design concept is that two lines are in production, with a third line on stand-by. The feedstock is of low quality at around 4 MJ/kg, which can be increased to design specification at around 5-6 MJ/kg after reduction (removal of construction waste, leachate drainage) before it is fed to the furnaces. The incinerator does not have shredders or any other particular form of pretreatment to homogenize and grade the waste. This has negative consequences for the combustion process. The waste buffer capacities at the unloading area and the feeding bunker are limited but sufficient for the current operation.

3. The plant uses the Circulating Fluidized Bed (CFB) technology which outside China is not very common for mixed municipal solid waste (MSW) and is mainly applied to the incineration of homogeneous and mostly high calorific value materials such as sewage sludge. Advantages are high heat turnovers and low reaction volumes, which makes these plants relatively inexpensive to build. Also combustion temperatures can remain relatively low which helps reduce NOx emissions. Downside is that these systems are less robust in management of inhomogeneous waste (such as MSW) with pretreatment issues easily leading to plant down-time. This is apparent in the limited undisturbed production cycles for individual incinerator lines with for this plant, which do not go beyond 2-3 days. The fact that one line is always available on standby probably has an impact on the maximum run-time of individual lines. Process control is achieved through feedstock and coal dosage, air flow control and temperature control of the inlet air (pre-heating) and the circulating ash. Main control parameter is combustion temperature. There is no optical monitoring of reactor bed temperature distribution. The plant is facing frequent operational problems in keeping process parameters stable. Also during the visit, reactor temperatures varied considerably and additional coal injection was needed to maintain temperatures above the minimum level, resulting in fluctuating readings of up to 950^{o}C in the combustion zone. Coal dosage can normally remain below 3% and total organic carbon (TOC) content of bottom ash/slags is around 2% (should be <3%). Energy (recovery) efficiency is

around 20% which is at the lower end of international standards for electricity production only which are at 17-30% (energy efficiency can approach 100% if other options can be made to work such as heat/steam sales).

4. Each production line has an adequate distribution of temperature and pressure meters, although shielded thermocouples are used for temperature metering which are not reliable without calibration against suction pyrometers; the latter doesn't happen. Oxygen content is metered at the inlet of the economizer. Other parameters are measured at the combined stack, including CO and water vapor, which therefore are not of use for process control. The plant has a central control room and a Programmable Logic Controller (PLC) based control system.

5. Flue gas treatment consists of semi-wet removal of acidic gases based on lime injection; activated carbon injection also for PCDD/furan removal and bag filters. The bag filters are compartmented with differential pressure metering and possibility to block out for each bag filter section. There is no de-NOx-facility but if legally required, there is the option to retroactively fit it in.

6. Flue gas monitoring is limited to stack emissions and continuous for HCl, SO2, NOx, NO2, dust, CO, H2O, O2, CO2, HF, pressure, temperature. Emission data is recorded with a decentralized separate control system, but readings are available in the central control room. Monitoring is limited to the combined stack only; therefore data cannot be attributed to the performance of individual lines if more than one line is in operation.

7. Conclusion – The XiShan plant is well maintained (still relatively new), has qualified operational staff and has control systems in place that should allow for readily adaptation of an operational and environmental performance enhancement program. There is much scope for operational improvements, including the need for investments in monitoring equipment for plant performance and environmental performance, and a certain level of integration of environmental performance monitoring and process control. This could be further detailed during the environmental and operational performance audit at the start of project implementation. A point of concern is the lack of pretreatment (including shredding) which is critical for mixed waste fluidized bed incineration and stabilizing process conditions. It is recommended to include arrangements for pretreatment in the agreement to participate in the Project program.

WuHua

(Fluidized bed incinerators, 3 x 500t/d installed capacity, official operation since July 2008)

8. The plant receives about 1,050t/d of household waste. After reduction (taking out lumpy waste pieces, particularly construction waste; drainage of leachate) the remainder is fed to two incineration lines. The design concept is that two lines are in production, with a third line on stand-by. The feedstock is of low quality at around 4 MJ/kg, which can be increased to design specification at around 5-6 MJ/kg after reduction (removal of construction waste, leachate drainage) before it is fed to the furnaces.

9. Incineration technology is CFB, similar to the XiShan plant. The similarities extend in broad lines to overall plant configuration, PLC based process control system, flue gas treatment system and environmental monitoring system. The main difference is that one year ago the WuHua plant installed shredders for pretreatment of the incoming mixed waste. This had a major impact on system operations and substantially reduced down-time (lines have been running for a week in a row). Coal dosage can normally remain below 3% and total organic carbon (TOC) content of bottom ash/slags is around 3%. Energy efficiency is around 20%.

10. Flue gas environmental monitoring is also similar to what is available with the XiShan plant but major problems have occurred. HCl monitoring has been absent for the last three years and the overall system is highly unreliable. The mother company recently approved investment planning for new equipment. Also here emission data is recorded with a decentralized separate control system and some (3) readings are available in the central control room.

11. Conclusion – Also the WuHua plant is well maintained, has qualified operational staff and control systems in place that should allow for ready adaptation of an operational and environmental performance enhancement program; with much scope for operational improvements, including the need for investments in monitoring equipment for plant performance and environmental performance, and a certain level of integration of environmental performance monitoring and process control. Noteworthy is the apparent readiness to invest, e.g. in the pretreatment system and the environmental monitoring equipment.

DongJiao

(Fluidized bed incinerators, 4 x 550t/d installed capacity, official operation since March 2011)

12. Normally, the plant receives about 1,200-1,300t/d of household waste. After reduction (taking out lumpy waste pieces, particularly construction waste; drainage of leachate) the remainder is fed to three incineration lines. The design concept is that three lines are in production, with the fourth line on stand-by. The feedstock is of low quality at around 4 MJ/kg, which can be increased to design specification at around 5 MJ/kg after reduction (removal of construction waste, leachate drainage) before it is fed to the furnaces.

13. Incineration technology is CFB, similar to the XiShan and WuHua plants. This also applies in broad lines to overall plant configuration, PLC based process control system, flue gas treatment system and environmental monitoring system. Also similar to the WuHua plant, the DongJaio plant has installed shredders for pretreatment of the incoming mixed waste. During the visit the plant was in the process of recovering from temporary shut-down due to power supply problems. In general, the plant appears to face serious operational issues. One important bottleneck is the very limited storage capacity in the waste pretreatment area (around half a day). It is therefore not uncommon that untreated waste is being fed directly to the furnaces, instead of being pretreated. During the visit, there were considerable process control issues with almost all furnace/combustion zone temperature readings below 800^{o}C despite control loops to reduce waste charge rates and increase coal dosage under these circumstances. Also problems with

leachate management occur, which are currently subject to a feasibility study to explore system modifications. Total organic carbon (TOC) content of bottom ash/slags is around 1%.

14. Flue gas environmental monitoring is also similar to what is available with the XiShan and WuHua plants. Also here emission data is recording with a decentralized separate control system but for the DongJiao plant without any readings in the central control room.

15. Conclusion – Also the DongJiao plant is well maintained, has qualified operational staff and has control systems in place that should allow for ready adaptation of an operational and environmental performance enhancement program; with much scope for operational improvements, including the need for investments in monitoring equipment for plant performance and environmental performance, and a certain level of integration of environmental performance monitoring and process control. The plant is challenged by some operational issues that at least to a certain extent are related to buffer capacity mismatches in the waste unloading / pretreatment and feeder area. These would need a thorough review during the Project initial operational and environmental plant performance audit.

KongGang

(Grate bed incinerators, 2 x 500t/d installed capacity, official operation since August 2013)

16. The plant normally receives about 500-600t/d of household waste. The design concept is that both lines are in production, but often one line is sufficient due to the limited supply of feedstock. During the visit, the plant was running at maximum capacity at around 1,100t/d of waste because of the operating problems and temporary shut-down at the DongJiao plant. The plant is designed to receive waste at the net calorific value of 4-7 MJ/kg. Common values are around 5 MJ/kg.

17. The plant uses a grate incinerator (Martin technology) which is worldwide the most commonly applied technology for mixed household waste. Grate incinerators are designed to manage mixed waste without extended pretreatment. There should therefore be no problem to run at full capacity for prolonged periods of time without standby capacity, which is also the case for the KongGang facility. Process control is achieved through feedstock and diesel oil dosage, air flow control and temperature control of the inlet air (pre-heating) and the grate speed. Main control parameter is combustion temperature. There is optical monitoring of the grate temperature distribution. During the visit, although temperatures appeared above 850^{o}C, some inconsistencies in reactor temperature readings were noted which were by the operators attributed to (wrong) locations of temperature meters. The mission noted that problems could also be related to the type of meters (thermocouples). Diesel dosage is rarely required and total organic carbon (TOC) content of bottom ash/slags is around 3%.

18. Each production line has an adequate distribution of temperature and pressure meters, although shielded thermocouples are used for temperature metering which are not reliable without calibration against suction pyrometers; the latter doesn't happen. Oxygen content is metered at the outlet of the economizers. For this plant, environmental flue gas parameters are

measured at both production lines (the plant has a multi-stack with individual stacks for each line), including CO and water vapor. The plant has a central control room and a PLC (Programmable Logic Controller) based control system.

19. Flue gas treatment consists of semi-wet removal of acidic gases based on lime injection; activated carbon injection also for PCDD/furan removal and bag filters. The bag filters are compartmented with differential pressure metering and possibility to block out for each bag filter section. There is no de-NOx-facility but if legally required, there is the option to retroactively fit it in.

20. Flue gas monitoring is continuous for HCl, SO2, NOx, dust, CO, H2O, O2, HF, pressure, temperature. Emission data is recording with a decentralized separate control system, but readings are available in the central control room. Although the environmental monitoring data recordings for all plants look questionable for certain parameters, for the KongGang plant they appeared totally off during the visit with for instance readings for carbon monoxide and dust of 0(!) mg/Nm^3 and 0.19(!) mg/Nm^3, respectively. These problems have been identified, also by the EPB. Flue gas monitoring has been contracted out and the KongGang plant is currently looking at options to bring this function to the required standards.

21. Conclusion – The KongGang plant is well maintained (still relatively new), has qualified operational staff and has control systems in place that should allow for readily adaptation of an operational and environmental performance enhancement program. There is scope for operational improvements, including the need for targeted additional investments in monitoring equipment for plant performance and environmental performance, and a certain level of integration of environmental performance monitoring and process control. This could be further detailed during the environmental and operational performance audit at the start of project implementation.

Overall Conclusions and Recommendations

- All plants have in varying degrees scope for improvements in system control to stabilize process conditions and optimize for a broader range of process and environmental parameters than what is now considered for daily operations. There is also substantial scope to integrate monitoring of process and environmental parameters and use more comprehensive data from this for process control and optimization. This will require investments in equipment for process control (instrumentation, control system, environmental monitoring), a thorough review and modification of operational procedures and corporate management commitment of the participating plants to make the required efforts to implement improvement programs.

- In addition, for some plants additional investments are required, e.g. in the waste reception and waste pretreatment areas (see plant briefs).

- Shortcomings in environmental monitoring, scope for improvement in process control and the need for additional investments can be determined in the comprehensive operational and environmental performance audits that are scheduled under the Project for each participating plant and should form the basis for improvement programs and management agreement to implement these programs including the required investment (to the extent not financed from the Project).

- All plants have a satisfactory level of maintenance and management, operational skill sets and control systems should be adequate as the starting point for the envisage improvement programs. Although tight financial management is apparent, is seems that the plants have opportunities for investments when needed. This should be confirmed when specific investments needs are identified during the first-year performance audits.

- One observation of the mission is that certain environmental monitoring elements are not working (sometimes for longer periods), that a substantial number of recordings are off or questionable, that calibration and verification are below required standards and that also certain critical process parameters (such as temperature) are not systematically monitored for environmental monitoring / enforcement purposes. The improvement programs with the waste incinerators should therefore by mirrored by matching monitoring and enforcement programs by the regulators (EPB).

Preliminary Capital Investments Identified during Project Preparation

22. A set of capital investments, largely consisting of pollution control equipment were identified for four candidate demonstration incinerators in Kunming. Those incinerators that commit to implementing the operational improvement program and have adequate available financial resources to cover the recurrent costs associated with improved operations as well as the counterpart funds for the capital investments would be selected to receive grants to partially fund these investments. The capital investments would be finalized in the light of the findings of the audits.

23. The preliminary capital investments and financing arrangements are as follows:

Konggang (Total cost: USD 0.67m)
GEF funded (USD 0.45m): (i) Triboelectric fabric filter bag leak detection system; (ii) New boiler ash purging system; (iii) Upgrading active carbon and lime slurry metering device, adding boiler temperature measuring points, installing new metering devices for active carbon and lime slurry injection.
Company funded (USD 0.22m): (i) Improved de-odoring system for the whole factory, improve the ash removal and drainage device at bag house, light-emitting diode (LED) display panel; (ii) Steam turbines noise control equipment; and (iii) Installation, designs and miscellaneous.

Dongjiao (Total cost: USD 8.81m)
GEF funded (USD 1.86m): (i) Metering devices for active carbon and lime slurry injection; (ii) Devices for replacing bag house with polytetrafluoroethylene material with membrane; (iii) Triboelectric fabric filter bag leak detection system.

Company funded (USD 6.95 m): (i) Renovation of waste pretreatment system, and (ii) Installation, designs and miscellaneous

Wuhua (Total cost: USD 2.74m)
GEF funded (USD 1.64m): (i) New Venturi pipe and metering devices for active carbon and lime slurry injection; (ii) triboelectric fabric filter bag leak detection system; (iii) replacement of three sets of the bag house with polytetrafluoroethylene (PTFE) material with membrane; (iv) three sets of hoppers to drain accumulated fly ash from the U-shaped ducts, (v) three sets of induction fan and its motors.
Company funded (USD 1.1m): Installation, designs, and miscellaneous

Xishan (Total cost: USD 3.09m)
GEF funded (USD 1.39m): (i) New Venturi pipe and metering devices for active carbon and lime slurry injection; (ii) Triboelectric fabric filter bag leak detection system; (iii) Replacement of three sets of the bag house with polytetrafluoroethylene material with membrane; (iv) Three sets of hoppers to drain accumulated fly ash from the U shaped ducts.
Company funded (USD 1.0m): Installation, designs, and miscellaneous

MAP IBRD40777