PROJECT BRIEF (27Apr07rev)

1. IDENTIFIERS

PROJECT NUMBER:	GF/CPR/07/XXX
PROJECT TITLE:	Environmentally Sustainable Management of Medical Wastes in China
PROJECT DURATION:	5 years
IMPLEMENTING AGENCY:	United Nations Industrial Development Organization (UNIDO)
EXECUTING AGENCY:	State Environmental Protection Administration (SEPA)
PRINCIPAL COOPERATING AGENCIES:	Ministry of Health (MOH)
REQUESTING COUNTRIES:	People's Republic of China
ELIGIBILTY:	Eligible under para 9 (a & b) of the GEF Instrument. The People's Republic of China has signed and ratified the Stockholm Convention on Persistent Organic Pollutants (POPs)
GEF PROGRAMMING:	Operational Programme (OP) #14

BENEFIT:

The project will be able to generate significant local, regional and global benefits as follows:

- Local benefits include reduced cases of cross-infection by infectious medical waste (MW) and injuries by sharps, and reduced exposures of local population through inhalation of airborne emissions.
- Regionally and globally the importance of the project cannot be overstated as it directly impacts on the safe management of MW generated by more than 25% of the global population.
- The project necessarily addresses the issue of infection control in the Chinese Health Care Sector and builds on the positive platform already established for the management of Severe Acute Respiratory Syndrome (SARS), the control of which has a global significance.
- The proposed structured approach to MW management constitutes preventive management and reduces the risk of the future outbreaks of infection, which could have international consequences in a globalized environment.
- The project addresses the reduction of polychlorodibenzo-p-dioxins and polychlorodibenzofurans (PCDD/PCDFs)[1] and other persistent organic pollutants (POPs) releases into the atmosphere, the reduction of which is a global priority.

[1] PCDD/PCDF, or dioxins is used in this document as a general term that describes a group of 210 chemicals that are highly persistent in the environment. The most toxic compound is 2,3,7,8-tetrachlorodibenzo-p-dioxin or TCDD. The toxicity of other dioxins and chemicals like PCBs that act like dioxin are measured in relation to TCDD.

- The project will address the measurement and quantification of MW waste generation and disposal including the quantification of pollutant releases. These management tools provide a basis to verify international environmental treaties and to communicate with the international community.

2. PROJECT SUMMARY

Based on the extensive barrier analysis of medical waste management, treatment and disposal in China, the project is determined to carry out the demonstration and replication of best available techniques and best environmental practices (BAT/BEP) in the environmentally sound management of medical waste to continuously reduce PCDD/PCDF releases by upgrading the incineration equipment and APCS to the BAT level and replacing outdated or over-capacity incineration facilities with alternative, non-incineration techniques that avoid the release of PCDD/PCDF.

To achieve the goal, the regulatory, administrative, planning, technical, economic, market, information and training instruments are designed and will be applied comprehensively during the implementation of the project to: (i) promote the locally affordable or commercially available supply of technologies and equipment needed and (ii) promote the commercialization of domestically constructed medical waste treatment and disposal facilities. This extensive capacity building program aiming at regulatory framework strengthening, institutional strengthening, and promoting local manufacturing industry and services will be carried out nationwide.

Given the fact that great differences exist in socio-economic, geographic, cultural and ethnic aspects among the eastern, central and western regions of China and between the densely populated urban areas of advanced development and remote, under populated and underdeveloped rural areas, no single model of BAT/BEP can govern the entire situation throughout the country. BAT/BEP needs to be modified, demonstrated and verified in different regions with particular reference to the specialization of the medical institutions, the type of dedicated treatment and disposal facilities, and the availability of relevant infrastructure and logistics. Therefore, one representative province will be selected from each of the region for a meaningful cluster of demonstrations in applying BAT/BEP.

In the cluster, medical institutions will be assisted to adopt BEP in medical waste segregation and reduction at source as well as temporary storage and transfer to dedicated facilities. Dedicated disposal facilities, will keep the incineration and pyrolysis processes and PCDD/PCDF releases under optimal control to meet performance levels associated with BAT, while diverting a significant portion of medical waste to alternative processes such as autoclaving, microwaving, and chemical disinfection that avoid unintentional production of PCDD/PCDF. Coordinated treatment and disposal with an effective medical waste transfer system among incineration and non-incineration facilities will be planned and implemented at the provincial and regional level in the cluster to optimize the performance and functions of facilities in a fit-for-purpose and least costly way.

In order to avoid unnecessary duplication and achieve the highest cost-effectiveness, successful experience in applying BEP in medical institutions and establishing the complete cluster by coordinating related dedicated treatment and disposal facilities will be learned from the cluster demonstration in the selected province that can be replicated to other provinces in a regional context.

The dissemination of BAT/BEP applications using the cluster concept will be promoted nationwide. The project will deliver extensive trainings to enhance technical competencies and establish the personnel training system to disseminate the successfully demonstrated experience for environmentally sustainable medical waste management. Information will be widely and openly disclosed through a dedicated project website to facilitate the dissemination. Necessary administrative instruments will be taken and market based incentives will be fully brought into action to ensure the effectiveness and efficiency of the replication program.

3. COST AND FINANCING

		Amount (US$)
GEF		***11,650,000***
Co-Financing for Full Project:		***33,077,140***
GEF IA	UNIDO (in-kind)	100,000
Governments of	China (in cash/in-kind)	23,300,000
	United States of America (in cash/in-kind)	120,000
Other	Chinese enterprises (in kind)	9,557,140
Total Project Costs		**44,727,140**

4. BASE LINE:

The outbreak of SARS in 2003 exposed significant shortcomings in the infection control practices and environmental management of medical waste in China. The Government of China responded to the public health crisis at three levels:

- Immediate commissioning of 70 quick-response temporary incinerators;
- Preparation of a plan to establish 332 dedicated medical waste disposal facilities throughout China; and
- Issuance of emergency regulations to control SARS-like biological hazards.

While these measures were viewed as crucial to combat the SARS crisis, they were developed and implemented in an emergency context and so were not in a position to develop a comprehensive system to manage medical waste, along with the individual, institutional and policy capacity to make it work.

In the absence of this project, the medical waste disposal sector in China is characterized as follows:

- A regulatory framework focused on infection control;
- Under-developed institutional capacities, in terms of both hardware (infrastructure) and software (skills and expertise) for supervision and inspection of medical institutions and medical waste disposal facilities in terms of pollution control and monitoring, environmental impact assessment, and operation risk evaluation;
- Incinerators continue to play the predominant role in the disposal of medical waste and generate unintentional POPs releases that significantly exceed BAT performance levels;
- Non-combustion alternatives, which can avoid formation of PCDD/PCDF have not been adopted;
- Integration and coordination of medical waste management, treatment and disposal systems have not been explored to achieve optimal social, economic, and environmental benefits;
- National debts and local government investments remain the principal financial source for construction of dedicated medical waste disposal facilities, but are unsustainable;
- Stakeholder awareness regarding secondary pollution from medical waste disposal is insufficient; and
- The fee-based system supporting medical waste management, treatment, and disposal systems has not been operated adequately and effectively.

5. GEF OPERATIONAL FOCAL POINT ENDORSEMENT

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Date: 25 September 2005

6. IMPLEMENTING/EXECUTING AGENCY CONTACT

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LIST OF ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
AIDS	Acquired Immure Deficiency Syndrome
APCD	Air pollution control device
APCS	Air pollution control system
APR	Annual Project Report
AQSIQ	Administration of Quality, Supervision, Inspection and Quarantine
BAT	Best available techniques
BEP	Best environmental practices
BOO	Build-Operate-Own
BOT	Build-Operation-Transfer
CAS	Chinese Academy of Sciences
CCCEPI	China Certification Center of Environmental Protection Industry
CCME	Canadian Council of Ministers of the Environment
CEMS	Continuous Emission Monitoring System
CICG	Convention Implementation Coordinating Group
CIO	Convention Implementation Office
COP	Conference of Parties
CPCB	Central Pollution Control Board
CSC	China Standard Certification Centre
CTA	Chief Technical Advisor
DEHP	Diethylhexylphthalate
EMS	Environmental Management System
EPA	Environmental Protection Agency
EPB	Environmental Protection Bureau
EIA	Environmental Impact Assessment
EU	European Union
FECO	Foreign Economic Cooperation Office
GAC	General Administration of Customs
GEF	Global Environment Facility
MW	Medical waste
MWI	Medical waste incinerator
IHB	Institute of Hydrobiology
IR	Inception Report
MI	Medical Institution
MOA	Ministry of Agriculture
MOC	Ministry of Construction
MOEF	Ministry of Environment and Forests
MOF	Ministry of Finance
MOFA	Ministry of Foreign Affairs
MOFCOM	Ministry of Commerce
MOH	Ministry of Health
MOST	Ministry of Science and Technology
NCG	National Coordination Group
NDRC	National Development and Reform Commission
Ng	nanogram
NGOs	Non-governmental Organizations
NIP	National Implementation Plan
NPHMW	National Plan for Construction of Facilities for Disposal of Hazardous Waste and MW
NSMNI	National Standard for Management on Nosocomial Infection
NTA	National Technical Advisor
OP	Operational Program
PCDD/PCDF	Polychlorodibenzo-para-dioxins and Polychlorodibenzofurans

PIR	Annual Project Implementation Review
PM	Particulate matter
PMO	Project Management Office
POPs	Persistent Organic Pollutants
PVC	Polyvinyl chloride
RETAP	Retired Engineering Technology Assistance Program
RIHM	Research Institute for Hospital Management
SARS	Severe Acute Respiratory Syndrome
SEPA	State Environmental Protection Administration
SERC	State Electrical Regulation Commission
SUD	Single use device
TCDD	Tetrachlorodibenzo-p-dioxin
TCG	Technical Coordination Group
TEQ	Toxic Equivalent (dioxin emissions)
TOT	Transfer-Operate-Transfer
TTR	Terminal Tripartite Review
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNIDO	United Nations Industrial Development Organization
UPOPs	Unintentionally produced POPs
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound
WB	The World Bank
WHO	World Health Organization

TABLE OF CONTENTS

1.0 PROJECT DESCRIPTION: BACKGROUND AND CONTEXT

1.1 Context/History

a. Overview

1. Medical waste is generated by medical institutions and research facilities in the delivery of healthcare including diagnosis, treatment and research. Medical waste is bio-hazardous with a potential to spread infection and has much higher potential than common municipal wastes to cause pollution during disposal because of its characterization. Medical waste therefore requires safe management throughout the complete life cycle in order to safeguard public health and protect the environment.

2. Growing public awareness of the global hazards of MW has placed new demands and urgency on the approaches to treatment and disposal practices. Technologies, techniques and practices are evolving to a more scientific and sustainable MW management model.

3. In the past, even in developed countries, MW was mainly incinerated on site, or directly landfilled without prior treatment. After 1980, environmental and hygienic regulations were strengthened in the light of clearer scientific knowledge and supported by increasing public awareness of the risks. Developed countries have now evolved an integrated model of systems management for the total life cycle of MW from materials procurement through usage to final disposal with the twin priorities of infection control and the prevention of pollution.

4. After 1990, health and environmental scientific research institutions in developed countries concluded that disposal of all MW by uncontrolled incineration would lead to severe environmental pollution. Incineration of the significant fraction of polyvinyl chloride (PVC) plastic and other chlorine compounds in MW can form PCDD/PCDF, which are emitted into the air or captured in residues in case the facility does not have a sophisticated air pollution control device (APCD). Arising from international treaties and individual government actions, the levels of authorized emissions to air have been severely curtailed in developed countries. As a result, incineration technology, once used as the main technology for disposal of MW, is gradually being replaced or supplemented by alternative non-incineration technologies that do not emit significant air emissions and in particular POPs.

5. Ironically, at a time when developed countries are moving to replace and augment incineration with non-incineration technologies for MW treatment and disposal, incineration technology is being promoted in developing countries. Developing countries generally seem less aware of air pollution arising from incineration of MW. On the other hand new generation incineration technology has marginally improved creating a climate where there is little incentive for developing countries to seriously consider alternatives.

6. Apart from the obvious issue of the choice of technologies, developing countries also have reduced capacity for realizing sustainable management of MW in many other key aspects of the waste cycle from generation, source reduction, classification, segregation and streaming, and pollution control. The safe and efficient management of the total lifecycle of MW is critical, but significant institutional capacity is required. Developing countries are generally disadvantaged because of the significantly lower levels of economic development, regulatory, enforcement and monitoring systems, support of manpower and financial resources, scientific research capacity, systematic training of MW management and disposal personnel, and awareness of environmental protection.

7. Following the outbreak of SARS in June 2003, the Government moved quickly to establish the National Plan for Construction of Facilities for Disposal of Hazardous Waste and Medical Waste (NPHMW), in which China is committed to construct 332 dedicated MW disposal facilities

across the country. Similar with the practice in many other developing countries, the NPHMW envisaged adopting incineration as the technology of choice for most of these facilities. Faced with an urgent public health crisis, the government quickly established emergency incineration facilities to safely dispose of MW. The urgent expansion of the incineration program did not however fully take into account China's obligations under the Stockholm Convention.

8. The Stockholm Convention entered into force on 11 November 2004 for China. Article 5 of the Convention requires the Parties to take measures to reduce or, where feasible, eliminate releases of PCDD/PCDF and other unintentionally produced POPs (UPOPs) in Part I from sources listed in Part II and III of Annex C. Waste incinerators, including co-incinerators of municipal, hazardous or MW or of sewage sludge are on the foremost top of the list. In the National Implementation Plan (NIP) of China for the implementation of the Stockholm Convention on POPs, MW incineration is listed as a key PCDD/PCDF release source and, pursuant to the "Action Plan for Reduction and Elimination of PCDD/PCDF Releases", priority should be given to the application of best available techniques and best environmental practices (BAT/BEP).

b) Socio-economic background

9. Consistent with the worldwide trends in healthcare delivery, China has moved in the1980s from a system, which did not readily dispose of clinical equipment and materials, to a system that relies much more on single-use and disposal. This change has resulted in significantly more volumes of MW being generated in the country today. The nature and characteristic of the MW has also changed significantly with plastics and polymers contributing large fraction to the overall mixture.

10. Improved management, particularly in the field of infection control, did not match changes in the healthcare delivery system in the field of modern materials and equipment. The absence of effective infection control measures created an environment where the risks of cross infection and hospital acquired infections was increased. This increased risk was in turn met by an even greater reliance on single use disposable clinical equipment and materials resulting in even more MW being generated. This, coupled with the socio-economic indicators of economic development including increased life expectancy and care of the aged creates increased demand for healthcare services leading to a continuous upward trend in the volumes of MW being generated for the foreseeable future.

11. Surveys and inventories carried out during the preparatory phase of the project revealed that the net amount of MW, excluding domestic waste produced in healthcare settings nationwide in 2006, was approximately 670,000 tons, with a daily average output of 1,780 tons. It is estimated that the annual generation of MW in China will be up to 680,000 tons by 2010.

c) Regulatory and policy context

12. Since the late 1980s, a series of laws, regulations and standards for MW management have been promulgated in succession by the Congress, its Standing Committee, the State Council, relevant ministries and local governments in China that created an emerging legislative context for this proposed project (see Table 1 below).

Table 1: Laws, regulations and standards on MW management

Law/regulation/standard		Issued by	Date of issuance
Laws	Environmental Protection Law of the People's Republic of China	Standing Committee of the National People's Congress	December 1989
	Law of the People's Republic of China on the Prevention and Control of Environmental Pollution Caused by Solid Wastes	Standing Committee of the National People's Congress	Entered into force in April 1996; revised in April 2005
	Law of People's Republic of China on the Prevention and Control of Infectious Diseases	Standing Committee of the National People's Congress	September 1989
Regulations	Regulations on Management of Medical Waste	State Council	2003
	Measures for the Administration of Operating Licenses for Hazardous Wastes	State Council	2004
	National Catalogue of Hazardous Wastes	SEPA, the former SETC, the former MOFTEC	July 1998
	Measures for Manifest Management on Transfer of Hazardous Wastes	SEPA	October 1999
	Technical Policy for the Prevention and Control of Pollution Caused by Hazardous Wastes	SEPA	December 2001
	Catalogue of Classified Medical Waste	MOH	2003
	Circular concerning Implementation of Charging System for Disposal of Hazardous Wastes to Promote Industrialization of Hazardous Wastes Disposal	NDRC, SEPA, MOH, MOF, MOC	2003
	Measures for Management on Medical Waste of Medical and Healthcare Institutions	MOH	October 2003
	Measures for Administrative Penalty on Medical Waste Management	MOH	June 2004
Standards and Technical Guidelines	Pollution Control Standard for Hazardous Wastes Incineration (GB18484-2001)	SEPA	January 2002
	Standard for Pollution Control on Hazardous Waste Storage (GB18596-2001)	SEPA	July 2002
	Standard for Pollution Control on the Security Landfill Site for Hazardous Wastes (GB 18598-2001)	SEPA	July 2002
	Technical Standard for Medical Waste Transport Vehicle (GB 19217-2003)	SEPA	May 2003
	Technical Standard for Medical Care Incinerator (GB 19218-2003)	SEPA	May 2003
	Technical Specification for Centralized Disposal of Medical Waste (Trail)	SEPA	2003
	Criteria for Specialized Packages and Containers of Medical Waste and Regulations on Warning Labels	SEPA, MOH	2003
	Technical Requirements on Engineering Construction for Safe Landfill and Disposal of Hazardous Wastes	SEPA	January 2004
	Technical Specifications for Steam-based Centralized Treatment Engineering on Medical Waste (HJ/T276-2006)	SEPA	June 2006
	Technical Specification for Centralized Treatment Engineering for Incineration Disposal of Medical Waste (HJ/T177-2005)	SEPA	March 2005

Law/regulation/standard		Issued by	Date of issuance
	Technical Specifications on Centralized Treatment Engineering for Microwave Disinfection of Medical Waste (HJ/T229-2006)	SEPA	March 2006
	Technical Specifications on Centralized Treatment Engineering for Chemical Disinfection of Medical Waste (HJ/T228-2006)	SEPA	March 2006

13. The legal basis adopted by China for the management of wastes in various industries is consistent with "*the polluter pays principle*". While there is no specific mandatory provision addressing MW, the Environmental Protection Law of the People's Republic of China promulgated in 1989 and the Law of the People's Republic of China on the Prevention and Control of Environmental Pollution Caused by Solid Wastes promulgated in 1995 together with infection control and heath and safety regulations applies. This latter specifically includes Prevention and Treatment of Infectious Diseases Act (1989) and related provisions on the treatment of articles, sewage, feculence and excreta arising in healthcare delivery.

14. In addition, there are provisions in the National Standard for Management on Nosocomial Infection (NSMNI) released in 1994 and other related standards on methods for treatment of various infectious wastes, such as blood, body fluid, drainage, laboratory specimen, experimental animal, surgical waste, patient excrement and other healthcare delivery wastes.

- A series of regulations have additionally been promulgated to address the proper disposal of single use clinical materials and equipment requiring a combination of sterilization and destruction beyond possible reuse and recognition prior to disposal as non-hazardous waste in regulated landfills. Control and accountability measures are also stipulated by the regulations.

15. The Technical Standard for Sterilization was promulgated in 2002. It classifies medical waste in eight categories (general domestic waste, infectious waste, sharps, pathological waste, cytotoxic waste, chemical waste and radioactive waste) and provides specific minimum treatment requirements on disinfections or treatment for each category of medical waste. The standard sets a foundation for the appropriate operation of all treatment technologies including the levels of thermal exposure necessary to safely sterilize potentially infectious waste. The technical standard is particularly applicable to the selection and operation of non-incineration technologies including autoclave, microwave and chemical treatment technologies.

16. While the regulatory framework, supported with guidance and standards, has come into being, a change at ground level is proving challenging. Supervision and inspection on the implementation of the regulations and standards in the past years found that (i) hospitals still could not cover all aspects of MW management; (ii) incinerators in most hospitals had difficulty meeting the prescribed air pollution emission limits, and (iii) pursuant to the "*polluter pays principle*" the capacity of the hospitals and other medical institutions to address the complete spectrum of MW management is challenged with the issues of capacity, equipment, competence, awareness and funding.

17. An outcome of the response to the outbreak of SARS in the spring of 2003 was a coordinated approach to the management of MW. This approach dictated the abandonment of outdated incinerators in hospitals in favor of dedicated centralized MW treatment facilities that would be operated under strict management parameters and consistent with the best international practice. The response led to the formulation of the NPHMW jointly by the National Development and

Reform Commission (NDRC) and State Environmental Protection Administration (SEPA), which require the construction of 332 dedicated disposal facilities nationwide.

18. The coordinated national approach additionally facilitates the orderly establishment of these facilities as follows:
    - requirement to undertake an Environmental Impact Assessment (EIA)
    - continuous monitoring of solid, aqueous and air emissions and the reporting of results
    - use of environmental audit and the application of BAT and BEP to reduce emissions
    - establishment of regulations related to waste facilities

19. Besides the above laws and regulations for infection control and environmental protection associated with MW management and disposal, with the transition of China's economy from a planned to a more market led model, China has in recent years promulgated a series of laws, regulations and policies to provide a legal support framework to facilitate investment in the environmental protection sector and market led commercialization of appropriate segments of the waste sector including MW management.

20. In December 2002, the Ministry of Construction (MOC) specifies that the administrative departments in charge of the municipal public sector should (i) further transform the system of governmental management from direct management to macro-management; and (ii) encourage other public and private funding and foreign capital to invest in the construction of municipal public facilities to form a diversified investment pattern and consequently promote the market-based operation of the municipal public sector.

21. The Regulations on Management of Health Care Waste promulgated by the State Council in June 2003 specifies that dedicated MW disposal units may charge healthcare establishments for the recovery of the cost of MW disposal. This lays a legal foundation for market-based operation of the management and disposal of MW.

22. The Notice Concerning the Implementation of Fee-charging System to Promote Industrialization of Hazardous Waste Disposal released in November 2003 jointly by the NDRC, SEPA, Ministries of Health, Finance and Construction, requires that regional and local governments should be separated from enterprise management in hazardous waste disposal. A competition mechanism for the construction and operation of disposal facilities for hazardous wastes (including MW) should be introduced.

23. The NPHMW approved in December 2003 by the State Council requires that non-governmental funds should be actively encouraged to invest in the construction of hazardous and MW disposal facilities together with the governmental investment and the facilities should be operated by enterprises in a professional and efficient way.

24. While China has established a relatively complete regulatory framework for the MW management, there are important articles in the laws and regulations, which may be absent or impractical. The regulatory framework requires practical application and fine-tuning to assure its effectiveness. The gaps of the existing regulatory framework and their consequences are analyzed in Part 1.2 as a barrier to be addressed by this project by reviewing and bringing forward recommendations for the creation of an enabling regulatory environment.

d) Institutional settings

25. MW management in China involves a wide range of government functional departments of comprehensive planning, financing, health, environment, safety, transportation and construction under the existing regulatory framework. There are organizations with administrative functions of supervision and administration entrusted by the government such as the National Development and Reform Commission (NDRC), Ministry of Finance (MOF), Ministry of

Science and Technology (MOST), General Administration of Quality Supervision (AQSIQ), State Environmental Protection Administration (SEPA), Ministry of Health (MOH), Research Institute of Hospital Management (RIHM), Local Environmental Protection Bureaus (LEPB), Local health bureaus at county level and above, Pricing Bureaus and other government functional departments including the monitoring stations, industrial associations and training centers in both health and environment sectors. The responsibilities of the above-mentioned ministries, agencies and other institutions are given in Annex 3 of the Project Brief.

26. In general, all the aforementioned institutions have important and indispensable roles to play in realizing the life-cycle management of MW. In reality, their capacities for MW management are generally low and are at an early stage of development due to the very short time since China has formally begun to regulate MW management. There is also a great disparity of capacity among different institutions therefore top priority should be given to institutional strengthening.

e) Medical waste management in medical institutions

27. There is great disparity of economic development and allocation of medical resources among and within the Eastern, Central and Western regions of China. This has caused significant regional differences in the type and quantity of MW. Due to lack of data and absence of relevant surveys and statistics, it is difficult to make a precise estimation on the quantities of MW being produced at present in China. During the project preparatory phase, surveys were carried out to estimate the production of MW at several medical institutions (MIs) in five provinces distributed in the East, Centre and West of China. The estimations were extrapolated nationwide in order to indicate the whole picture of MW production in China.

28. From a planning perspective, it is considered necessary to critically determine the volumes of MW being generated. According to a study on safe management of wastes from healthcare activities prepared by the World Health Organization (WHO), the daily waste generation per bed calculated for China is approximately 1.8~2.2kg, in which about 80% waste is comparable to non-risk, general domestic waste and about 20% (or 0.36~0.44kg) is MW requiring special regulation. The survey made during the project preparatory phase indicated that the MW generated per bed per day in China is 0.37kg in 2005, very close to the result reported by the WHO. The Eastern part of China has the highest level of approximately 0.50kg, while the Centre has a moderate level of 0.3kg and the West with the lowest of 0.29kg, indicating the relationship with the economic development level of the regions.

29. China Health Statistical Yearbook 2006 shows that in 2005, the total number of hospital beds in the Eastern, Central and Western regions were 1,452,325; 1,033,700 and 881,477; and the outpatients 767,560,868; 328,481,304; and 300,591,229, respectively. Based on the generation factors determined above, it is estimated that the total production of MW nationwide in 2005 was approximately 540,000 tons, of which 55.4%, 25.5% and 19.1% were produced in the Eastern, Central and Western regions respectively. In 2006, the nationwide MW production totaled to 570,000 tons.

30. MW from different classes of MIs differs in character and volume due to their different service scope, content, level and target patient groups. MIs such as Class I hospitals, community health-care centers, outpatient departments and clinics generate little or no radioactive waste, pharmaceutical waste and pathological waste (e.g. body parts and consists mostly of infectious waste and sharps). MIs of Class II and III hospitals produce more types and higher amount of MW than MIs below Class II.

31. The type of MIs is another important factor for the generation of MW. The project preparatory phase survey results show that the daily MW generation per bed in infectious diseases hospitals is 1.31kg and that of general hospitals is 0.37 kg. MW of dental hospitals mainly comes from outpatients and the quantity produced per diagnosis is 0.08 kg by average.

32. Before June 2003 in China, most of the MW was disposed of in a decentralized way within MIs by simple incineration, causing severe secondary pollution and creating a serious risk to public health. China's standardized management of MW began just after the SARS outbreak. With the priority given by the Government to this issue, the management of MW within MIs has gained rapid progress. This has laid a favorable foundation not only for effective infection control but also for the future safe environmental management of MW including the implementation of international environmental protection conventions.

33. Pursuant to the Regulations on MW Management, most MIs have established a MW management system to deal with matters relating to hospital MW management. Duties of departments involved in the MW management are defined in the management system. For example, the department of general affairs and logistics is responsible for the collection, transfer and temporary storage of health care wastes. Healthcare doctors and nurses classify MW and the department of infection control is responsible for supervision, inspection and feedback on the treatment of MW. Emergency response plans in case of leakage of healthcare have also been established.

34. MW producing units classify MW pursuant to relevant laws and regulations of the state, and have MW collected, registered and temporarily stored by their logistics departments, and then handed over to MW centralized disposal units for off-site disposal or directly disposed of by the producing units themselves in a sound and safe manner. MW that is consigned to centralized disposal facilities generally includes infectious waste, unidentifiable pathological waste, sharps, etc. Identifiable body parts, organs and other pathological waste are generally transported to funeral parlors for incineration disposal. Pharmaceutical wastes, radioactive wastes and mercury-containing wastes are directly treated by waste producing units and are generally not handed over to centralized disposal centers for disposal.

35. Health administrative departments of various levels and professional societies have trained MW related staff in MIs on relevant knowledge and skills. Training materials in the forms of course materials, pamphlets, posters and CDs have been prepared and disseminated effectively. For example, the Tianjin Municipal Environmental Protection Bureau in cooperation with Tianjin Municipal Health Bureau produced CDs on Tianjin Children's Hospital MW management and distributed them to each MI in the municipality for publicity and training.

36. Along with the improvement in economic development and enhancement of public health awareness, the medical care level will also improve. The tendency of aging population in China is being intensified. The spectrum of diseases is gradually shifting to chronic non-communicable. As a result, the needs for medical and healthcare services are bound to increase on a continuous basis and the amount of MW to be produced will also increase accordingly. According to the MW increase rate of 6.67% determined by the project preparatory phase study, it is estimated that the annual generation of MW will be up to 680,000 tons in China by 2010. Proper management and treatment/disposal of such a huge amount of MW is a stern challenge for China to protect its environment and people to implement the Stockholm Convention for the reduction of PCDD/PCDF emission from MW incineration.

f) Medical waste disposal in dedicated facilities

37. As stated above, historically dispersed individual MIs disposed of MW. In 2003, when the NPHMW, shortly nationwide investment program, was approved and implemented, the centralized disposal of MW in dedicated facilities was introduced. This section introduces the construction, operation and planning of MW facilities in China before and after the Program from such aspects as disposal model (collective or separate), disposal technologies (incineration or non-incineration), disposal scale, PCDD/PCDF release, and operational management.

38. Medical Waste Incinerators (MWIs) namely, a 5t/d incinerator located in Beijing Chest Hospital and a 4t/d incinerator located in Benxi Municipal Waste Treatment Plant, Benxi City, Liaoning Province were first installed in China in 1990. Over the ensuing 10 years (up to 2000), 17 MW incineration facilities were constructed across the country. The national survey on hazardous waste and MW disposal facilities conducted by SEPA in 2005-2006 found that there are 149 dedicated MW treatment facilities, including 43 facilities built in response to SARS. There are still 263 simple MWIs in commission at MIs, which should be demolished according to the current laws and regulations.

39. The existing 149 dedicated MW treatment facilities (85 in the East, 33 in the Centre and 31 in the Western regions of China) have a total disposal capacity of 1,327 tons per day. The eastern region has the highest capacity of MW treatment in the country (775 tons per day or 336,000 tons per year) accounting for 58% of the national capacity. The treatment capacity of the Central and the Western regions is 318 t/d and 233 t/d, accounting for 24% and 18% of the national treatment respectively.

40. Incineration including pyrolysis is the most widely used technology in the existing MW disposal facilities. Among the 149 dedicated disposal facilities, one facility is using autoclaving technique, another facility apply microwaving imported from Canada and USA and all the others applies incineration or pyrolysis. Among the 149 incineration facilities, there are 10 rotary kiln incineration facilities with a relatively larger capacity generally ranging from 10 to 30t/d; the rest deploy pyrolysis furnaces, which have relatively smaller capacity than the rotary kilns. It should be noted that 70 incinerators have not installed even the basic APCD and majority of the remainder incineration facilities have limited devices to control the PCDD/PCDF emissions.

41. Most of the incineration facilities have unmeasured emission levels of PCDD/PCDF-like compounds. The estimation of annual air emissions of PCDD/PCDF from medical waste incinerators (MWIs) is quite dependent on extrapolations, engineering judgment and the use of assumptions. In addition, the information about the activity levels of these facilities is also quite limited.

42. In the development of the NIP, PCDD/PCDF releases from the incineration of MW in China were estimated based on the Standardized Toolkit for Identification and Quantification of PCDD/PCDF Releases under the assumption that all the MW incinerators are equipped with air pollution control devices. The result showed that in 2004 the total amount of PCDD/PCDF releases from MW incinerators in China reached 427.4g TEQ, accounting for 8.47% of the total releases to air from all sources listed in the Toolkit.

43. The success and sustainability of the project and its impact on the nationwide investment program will be assured by the fact that no funds for investment can be released without the review and endorsement of SEPA. Therefore for maximizing the project impact, its timely implementation has of crucial importance. The outputs and results of the project will be incorporated without delay into SEPA's review and decision process for approving new investment projects in the nationwide investment program, and thus SEPA will assure the sustainability and nationwide replication of the project.

1.2 Analysis of Barriers to Project Implementation

44. The proposed Project is faced with a variety of barriers that will need to be addressed to ensure its successful implementation and achievement of project objectives. These include:

- Tradition in hospitals of direct disposal of medical waste without treatment or with poorly designed treatment processes.

- Development of China's Nationwide Investment Plan for new medical waste treatment facilities without regard to BAT/BEP, minimized PCCD/F emission or consideration of non-combustion technologies.
- Existing laws and regulations are too general and may be impractical in some cases, and lack of detailed rules to support their implementation.
- The standards for the control of pollution from incineration are too low and the standards for the control of pollution from non-incineration treatment are still under development.
- Lack of inter-ministerial mechanisms to provide coordination and guidance upon cross-sectoral policy and implementation issues.
- Stakeholder conflict of interests.
- Weak institutional capacities for supervision and inspection of medical institutions and dedicated disposal facilities in the areas of pollution monitoring, environmental impact assessment t and operational risk assessment.
- Lack of BAT/BEP demonstration for the lifecycle management of MW including:
  - BEP in medical care institutions
  - BAT/BEP for incineration process of MW
  - BAT/BEP for pyrolysis process of MW
  - BAT/BEP for autoclaving process of MW
  - BAT/BEP for other technically available non-incineration processes of MW
  - Treatment and disposal of MW in remote rural areas
  - Integrated MW management among institutions
  - Regionally coordinated MW treatment in cluster among the dedicated MW facilities.
- Lack of techno-economic policies and incentives promoting adoption of BAT/BEP.
- Lack of certification and labeling program to provide open, reliable and comparable information on technical and environmental performances of MW treatment equipment for the disposal facility owners.
- Lack of commercially available options for diversified investment and professional operation in MW treatment and disposal facilities.
- Lack of effective personnel training systems to provide qualified human resources for BAT/BEP based lifecycle management of MW.
- Lack of stakeholder awareness
- Lack of effective mechanism to promote research, development and application of technically feasible and locally affordable processes, techniques and equipment.

Tradition in hospitals of direct disposal of medical waste without treatment or with poorly designed treatment processes

45. Prior to the SARS outbreak in June 2003 in China, most of MW were directly disposed of by hospitals and other medical institutions either without treatment or using poorly designed and managed processes of incineration, disinfection, sterilization, sharp destruction and recycle, thus resulting in a series of severe environmental and social problems.

Development of China's Nationwide Investment Plan for new medical waste treatment facilities without regard to BAT/BEP, minimized PCCD/PCDF emission or consideration of non-combustion technologies

46. The disposal of MW in a centralized manner started as an emergency after the SARS period in 2003, when China had not yet acceded to the Stockholm Convention yet. The NPHMW was mainly based on the relevant environmental protection and health standards available at that time and incineration technology was regarded as the primary disposal technology. The Program

laid emphasis on the elimination of safety and pollution threats posed by hazardous wastes and MW, and gave less consideration to the application of BAT/BEP necessary for the implementation of a total process management of MW as well as the control of the emission of PCDD/PCDF and other pollutants from the incineration of MW.

47. Article 5 of the Convention requires the Parties to take measures to reduce or, where feasible, eliminate releases of PCDD/PCDF and other unintentionally produced POPs, and to apply BAT for new sources and existing sources including MWIs. In the NIP of China, MW incineration is also listed as a key PCDD/PCDF release source and, pursuant to the "*action plan for reduction and elimination of PCDD/PCDF releases*" priority should be given to demonstration activities for BAT/BEP application.

48. However, the application of BAT/BEP in the whole process of the management and disposal of MW in China still faces a series of barriers. In order to effectively and precisely identify the barriers, international experience in applying BAT/BEP is given in Annex 1 "A summary of the international experience review particularly by developed countries", which was reviewed during the preparatory phase of the project to make a targeted comparison with China's actual situation.

49. The project will address this oversight in the NPHMW by working closely with national, provincial and local officials responsible for the implementation of the NPHMW to provide capacity building and technical assistance to aid in the development of waste management plans and in technology selection so as to allow the selection of the most cost-effective, environmentally beneficial technologies, coupled with the implementation of the BAT/BEP to minimize the overall system costs, inefficiencies and PCDD/PCDF emissions.

The existing laws and regulations are too general, and there is a lack of detailed rules to support their implementation

50. The outbreak and prevalence of Severe Acute Respiratory Syndrome (SARS) in 2003 signaled the grave deficiency of MW disposal in China. The Chinese Government gave great importance to this and promulgated in June of the same year the Regulations on Management of Medical waste (the "Regulations"), which provides a regulatory basis for MW management and government departments involved also released a series of supporting documents to facilitate the implementation of the Regulations. The promulgation and implementation of the Regulations and its supporting documents play a very important role in promoting and regulating MW management of the country.

51. Though China has established a basic regulatory framework for medical waste management and treatment, existing laws and regulations are too general and lack technical specifications and detailed rules to support their implementation. .

MW segregation

52. The segregation of MW is a key link for realizing waste minimization, recycling, disposal by sort and PCDD/PCDF release reduction.

53. The existing classification catalogue of MW is unspecific, making medical staff confused in segregation of MW. For example, there is no explicit provision on whether or not infusion bags, shoe covers and disposable respirators should be streamed into MW; orthopedic gypsum has a vague status of segregation, which is sorted into MW by many MIs and thus increases greatly quantities of MW. Take another example, in the Classification Catalogue of MW, mercury-containing waste is classified as chemical waste and listed among wastes with peroxy-acetic acid, which is scientifically inappropriate.

54. Another significant deficiency of the existing provisions on the segregation of MW is neglect of proper choice of disposal methods based on MW material composition. It puts focus on hygiene and human health protection and gives inadequate consideration to material of MW and to possible secondary pollution that may be caused in subsequent disposal. This has caused the incineration of chlorine donor and PVC-containing wastes with other wastes, extremely increasing the possibilities of PCDD/PCDF generation and releases against the BEP requirements. Thus, a more specific classification catalogue taking into consideration of the BEP requirements should be developed to guide and train MIs to sort and stream MW.

Operating license for hazardous wastes

55. Operation license for hazardous wastes (including MW) is an important administrative instrument for the supervision and management over MW disposal facilities. According to the Measures for the Administration of Operation Licenses for Hazardous Wastes officially promulgated on 1 July 2004, a unit operating MW disposal facility must, based on its technological level and facilities built, provide related technical supporting materials showing that its facility can meet with national or local environmental protection standards in order to obtain a license to be approved and issued by the municipal environmental protection bureau.

56. In the Measures for the Administration of Operation Licenses for Hazardous Wastes, there are some general provisions relating to the basic resource requirements on hazardous waste disposal facilities but there is a lack of specific specifications, which can guide the release, and management of operation licenses for MW. Local application of the operation license system shows that the many facilities still operate without a license. There is no detailed guidance on the issuance of licenses in the country. Thus, detailed implementation rules should be developed for carrying out the license system for MW treatment and disposal, so as to fully exercise the function of the system as an important supervisory and management instrument.

Hazardous waste consignment

57. The generation, collection, transport and disposal of MW are a complex system, which involves several sectors. Implementation of the consignment system for MW is an important means to prevent loss of MW and to ensure that MW are treated and disposed of safely and properly at each segment. According to the Measures for Manifest Management on Transfer of Hazardous Wastes formulated by the state, MW, as part of hazardous wastes are included in the management scope of the Measures.

58. The present MW transfer manifest adopts the format of the hazardous waste transfer manifest in quintuple copies, which is over complicated for the transfer management of MW. In practical implementation, some provinces modified the shipment requirements and even changed the manifest to three copies, which greatly reduced the effectiveness of this system. The manifest system is not implemented in some regions increasing the possibility of unaccountable loss and unauthorized disposal of MW is increased with the consequent potential health and environmental pollution risk.

59. Therefore, to bring the role of the manifest system for MW transfer into full operation, a dedicated MW transfer manifest should be formulated based on the present hazardous waste transfer manifest. This new MW transfer manifest should clearly define responsibilities of MW generation units, transport units and disposal units in the management on transfer of MW, explicitly specify information required to fill in, establishes data reporting and archiving systems, and gives due consideration to advanced information technology application in the MW management, so as to provide a substantial information support to environmental protection and health departments for supervision and management.

The standards for the control of pollution from incineration are too low, and the standards for the control of pollution from non-incineration treatment are still missing

60. Environmental standards are a special and important component of China's environmental regulatory system. The development of national environmental protection objectives and program, the formulation and implementation of environmental laws, the assessment and supervision of environmental quality and the supervision and inspection of environmental protection should refer to environmental standards.

61. To assure appropriate management and disposal of MW, the Government of China has established and improved its system of standards for MW on a continuing basis. The existing system of MW standards included 12 standards or specifications covering pollution control, technology and equipment, engineering construction and environmental monitoring. These standards play an important role in implementing related laws and regulations, protecting human health and the environment, facilitating the development of related industries, regulating the country's management and disposal of MW and improving the regional and global environmental quality.

62. However, the promulgation and implementation of the majority of these standards were ratified prior to China's accession to the Stockholm Convention. This led to an inadequate consideration of the requirements of BAT/BEP for all aspects of MW.

63. Overall, the present system of MW standards of China has the following problems:
- the system of standards is incomplete; and
- the existing standards cannot meet BAT/BEP requirements.

The standards for the control of pollution from non-incineration treatment are missing

64. The incompleteness of the specified standards for the assessment of and testing methods for effects of non-incineration treatment of MW creates difficulties. There is a lack of knowledge, relevant management and technical support available in this area. The lack of prescribed standards creates a blind spot, which makes it difficult for China's environmental protection departments to recognize and accept the high-temperature steam, microwave, chemical disinfection and other non-incineration technologies, which have been widely applied in the world, and thus restricts the opportunity for the introduction of non-incineration technologies in China. This lack of awareness on non-incineration technologies also helps to explain why the present disposal of MW excessively relies on incineration technologies.

The standards for the control of pollution from incineration are too low

65. The present MW standards fall behind increasingly innovative management and disposal technologies for MW. The Pollution Control Standard for Hazardous Wastes Incineration still adopt 0.5TEQng/Nm^3 as the emission limit of PCDD/PCDF in flue gas from incineration, while most of countries in the world have adopted the PCDD/PCDF emission below 0.1TEQng/m^3 achievable by the application of BAT/BEP under the Stockholm Convention. The low and inappropriate incineration emission limit favors the prolong use of outdated incineration equipment and impede the upgrading of equipment and technologies, compounding releases of PCDD/PCDFs and other pollutants and prevent China from fulfilling its obligations under the Stockholm Convention.

Lack of inter-ministerial mechanism to provide coordination and guidance upon cross-sectoral policy and implementation issues

66. An inter-departmental coordination mechanism is often used as an effective means to address comprehensive environmental protection issues by many countries in the world in their work on environmental protection. Like most other comprehensive environmental protection work,

disposal of MW is also cross-sectoral. Various aspects such as construction of MW disposal facilities, management of facility operation, and development of charging policy involve the responsibilities among different departments of environmental protection, development, health, safe production, communications, construction, industry and commerce, and pricing.

67. In China, various departments are responsible for the environmental protection work within their jurisdictions, and the environmental protection department carries out unified supervision and management. Due to administrative barriers existing among different departments and lack of a cross-sectoral coordination mechanism in place, the process of MW disposal is constrained. For example, coordination efforts have long been needed in such key segments as charging policy, facility construction, validation and market-based operations in order to achieve the goal of sustainable environmental management of MW.

68. To meet the obligations under the Convention as well as addressing environmentally sustainable management of MW, cross-sectoral coordination mechanism composed of relevant departments is required to provide guidance and coordination in the development of unified national and local policies and programs for MW management and disposal. To date, China has no inter-ministerial mechanism to provide this coordination among ministries at the national level and with local agencies. The project will rectify this problem through creation of inter-agency supervisory and working bodies to ensure communication and coordination between ministries and governmental levels.

Stakeholder conflict of interests

69. The municipal waste sector includes a large number of stakeholders, many of which have diverging (and sometimes conflicting) interests. For example, at the most basic level, medical waste treatment facilities may prefer high waste treatment fees in order to maximize revenues, while hospitals prefer low fees in order to reduce their costs. The project will attempt to address such risks by developing and implementing approaches that minimize total system costs, and then distribute those costs equitably among stakeholders in order to allow sustainable operation of the waste management programs in an environmentally sound manner. Other conflicting interests that may pose a particular threat to the project is when local waste management agencies may resist non-combustion technologies because they are heavily invested in or committed to incineration technologies and believe that non-combustion technologies would be implemented outside their sphere of influence. The project will address such risks by working with stakeholders to develop win-win approaches, including public-private partnerships and alternative ownership and operating approaches that will give all parties the incentives to select the most economically and environmentally sound technologies.

Weak institutional capacities for supervision and inspection on medical institutions and dedicated disposal facilities in terms of pollution monitoring, environmental impact assessment, and operation risk evaluation

70. China's standardized management of MW began just after the SARS outbreak in 2003. The administrative departments of health and environmental protection, particularly the latter, have accumulated very limited experience and gained weak institutional capacities for supervision and inspection on medical institutions and dedicated disposal facilities in terms of pollution monitoring, environmental impact assessment, and operation risk evaluation.

71. From the planning, design and installation to the operation of a dedicated health care disposal facility, the whole process is governed by a series of laws, regulations and standards. With the development of social economic and technological level, the systems will be continuously modified and improved. However, due to lack of a complete law enforcement and supervision system, it will be difficult to ensure sustainable, comprehensive and rigorous regulatory supervision and management. This is reflected in the following issues:

- No specifications for supervision over management of MW in MIs;
- In the stage of facility justification and approval, nonstandard granting of license;
- In the stage of facility construction, insufficient implementation of the environmental impact assessment system;
- Upon completion of the facility construction, lack of validation standards and means; and
- In the stage of facility operation, insufficient monitoring and evaluation on the operation process and insufficient supervision and inspection on enterprise's internal environmental management body, staffing and pre-job training, internal system building, emergency response and system of accountability.

Lack of effective supervision over management of MW in MIs

72. A good internal MW management system of a MI plays a significant role in MW minimization, reduction in POPs releases as well as in reducing damages to patients, the environment and society. The health administrative departments have integrated MW management into the routine supervision and management over MIs soon after the Regulations on Management of MW was promulgated and implemented.

73. At present, however, the health administrative departments have inadequate standards or guidelines for supervision. This has led to a situation in which the supervision on MW management varies from person to person and region to region, giving raise to confusion in MIs on the proper waste management practice. It is therefore necessary to formulate standards or guidelines for MW supervision and management in MIs so that MW management within MIs is strengthened and MW supervision regulated.

74. Because the manifest system for MW transfer has not been implemented effectively, such an important basic data on MW of various MIs in a region or across the country as source, type, composition, and quantity/weight is unavailable. This loss of data has substantially restricted the supervision of health administrative departments over MIs in MW management, prevented the environmental protection departments from developing feasible plans for MW disposal, and led to blindness in MW management and policy development.

75. It is therefore necessary to establish a MW data reporting system between MIs and the health administrative departments, considering the application of advanced information technologies, to facilitate the supervision over the MW management in a systematic and scientific way, to improve supervisory efficiency, and to provide a scientific basis for the development of relevant policies and plans on MW by the health and environmental protection departments.

Weak capacity for the supervision and monitoring of dedicated disposal facilities

76. The supervision and monitoring of pollutant releases are important means to ensure BAT/BEP application and up-to-standard emission in MW management and disposal sector. In the government's environmental protection agenda some of the main topics regarding the MW incineration system include the monitoring of PCDD/PCDF emissions and the setting of suitable automatic control systems both for the combustion process and for the main flue gas treatment devices, in order to limit the emission of harmful substances under the lowest limit achievable. At the same time, efforts must be made to set up online monitoring systems directly linked to the government's environmental protection supervision department. With a constant flux of data, the departments can be continuously informed on the running status of MW incineration facilities, evaluate the respect of the limits and intervene immediately in case of risk.

77. The Chinese Government has moved fast in issuing fundamental regulations and standards in respect with the control of pollution from MW disposal. However, the following gaps still exist in supervising and monitoring the implementation of these regulations and standards:

- Lack of technical specifications and instruments for the supervision and monitoring. For this reason, the environmental monitoring and enforcement authorities lack of supporting instruments necessary to supervise disposal facility operating units over the implementation of regulations and standards.
- Qualifications of enforcement forces have yet to be improved. Presently in China, the environmental enforcement forces at various levels are basically not capable of correct supervision and monitoring over the operation of MW disposal facilities. There is also a lack of a training system on MW disposal supervision.
- Deficiency in monitoring capacity. Local monitoring departments have the capacity for monitoring of general pollutants, but capacity for monitoring PCDD/PCDF from incineration and microorganisms and VOCs from non-incineration is still missing. Continuous emission monitoring system (CEMS) is generally not installed and operated. While a parallel project being proposed by China to strengthen its overall capacity for the convention implementation will bring about the capacity for PCDD/PCDF monitoring, sufficient capacity for continuous emission monitoring of general pollutants and monitoring of non-incineration treatment of MW should be developed.

Insufficient environmental impact assessment (EIA)

78. The system of environmental impact assessment (EIA) is one of China's basic systems for environmental protection. EIA is a process of analyzing, predicting and evaluating possible environmental impacts caused by the implementation of a program or project, with aims to propose actions and measures to prevent or mitigate adverse environmental impacts and to conduct follow-up monitoring of these impacts. EIA has three components, i.e. environmental impact assessment, post-assessment and follow-up assessment. The Chinese Government promulgated in 1998 the Management Regulations for Environmental Protection of Construction Projects, which definitely sets forth the system of environmental impact assessment; in 2003 it promulgated the Chinese Environmental Impact Assessment Law and the Technical Guidelines for Environmental Impact Assessment. China implements the qualification system of EIA engineers and has established a pool of EIA engineers composed of specialized technical personnel.

79. For the environmental impact assessment on construction of MW disposal facilities, S EPA, in an effort to support the implementation of the NPHMW, formulated in 2003 the Technical Principles for Environmental Impact Assessment of Construction of Hazardous Waste and MW Disposal Facilities (Trail). It specifies environmental management requirements on pollutants emission, technology selection, environmental condition survey, pollution prevention and control measures, etc. and provides specific guidance on EIA of MW disposal facilities.

80. Judged from the present construction of health-waste disposal facilities, EIA has been carried out for a majority of the facilities. Because China started relatively late in the MW management and disposal, foundations for effective EIAs are weak, and problems are reflected as below:
    - Incomplete contents. The Technical Principles for Environmental Impact Assessment of Construction of Hazardous Waste and MW Disposal Facilities (Trail) was formulated in 2003, which does not cover the principles and methodologies applied to the EIA of non-incineration technologies for MW because at the time incineration was promoted as a major disposal technology and awareness of non-incineration disposal technologies was inadequate. Even for incineration facilities, inadequate studies at the time could not provide better guidance on the EIA in the field. Thus the implementation of this project will greatly enrich and improve the environmental impact assessment on construction of MW disposal facilities.
    - Insufficient follow-up assessments and post-assessments. Though the present EIA system has relevant requirements on follow-up assessment and post-assessment, they are either given inadequate emphasis or not executed at all in practice. This makes it difficult to

carry out environmental impact mitigation measures proposed by EIA during construction period of a facility and also sheds some lights on the fact that most of the present facilities discharge pollutants exceeding limits. This project should apply EIA as an effective environmental management instrument and extend it to cover both the construction and completion acceptance stages of the facility to ensure the mitigation measures proposed are actually implemented.

- Deficient professional capacity of EIA personnel. China started relatively late in both application of disposal technologies and construction of dedicated disposal facilities for MW. New technologies such as chemical disinfection, microwave sterilization and high-temperature steam disinfection just started in the MW disposal sector. EIA agencies and personnel lack relevant expertise and experience. Therefore, to bring the role of EIA into full action, extensive trainings should be strengthened and delivered to relevant EIA agencies and personnel.

Lack of Assessment on Operation of Disposal Facilities

81. Ensuring the effective operation of MW disposal facilities is one of the key sectors of achieving the sustainable management of MW. Experience of foreign developed countries reveals that strengthening the assessment on operation of MW disposal facilities is an effective measure to ensure the safe operation of MW disposal facilities, which also provides the environmental protection department with technical support for supervision and management.

82. The process of applying healthcare disposal technologies is complex and inappropriate management of the operation process can increase risks to the environment. For example, inappropriate control of incineration technical parameters and pollution caused by tail gases could lead to PCDD/PCDF releases over exceeding standards; inappropriate control of key parameters of high-temperature steam, microwave, chemical treatment and other non-incineration technologies could also cause failure for microbes, VOCs and indicators to be up to standard, consequently bring about larger risks to public health and environment. It is difficult to discover these problems through simple routine inspections on site and only with standard assessment on the operation of facilities that the suitable technical support can be provided for the environmental protection department's supervision and management of MW disposal facilities.

83. To carry out operation assessment of disposal facilities, it is required to establish relevant management methods in such aspects as assessment agency, procedure and contents to regulate and provide guidance on the development of assessment work. Assessment agencies should carry out independent assessment on commission of the environmental protection department or facility operation units. The results should serve as an important reference for the environmental protection department to review operation licenses each year.

84. To promote standard operation and management of MW disposal facilities, a set of objective, scientific, fair and transparent assessment system, procedure and methodology should be established pursuant to BAT/BEP requirements, so as to strengthen capacity for the establishment of related assessment agencies, conduct assessment on operation of MW disposal facilities and provide powerful technical support for management by the environmental protection department.

85. Besides, large quantities of outdated and low technological level incinerators were built during the period of SARS and it is difficult to make them acceptable by technical retrofitting. Most of them are still in operation with very high emission of PCDD/PCDF and other air pollutants, far exceeding the limits. Therefore, the main task of the environmental protection departments is to strengthen the law enforcement and make a determined effort to shut down such facilities or replace them with alternatives.

Lack of BAT/BEP demonstrations for the lifecycle management of MW

86. Each country adopts different solutions to implement BAT/BEP, depending on its laws and regulations as well as on its social and economic conditions. Internationally, the Secretariat of the Basel Convention, the WHO, the Food and Agricultural Organization of the United Nations and other inter-governmental agencies and government organizations have provided guidelines of great reference value on the sustainable management of MW from their generation to final disposal. However, the practicability or feasibility of these guidelines has not been demonstrated practically and validated in China's MIs and dedicated facilities, and therefore difficult to be promoted.

87. The total process management of MW involves health, environmental protection, construction and other state departments, MIs and MW disposal enterprises. The disposal of MW is a systematical process, composed by many stages, such as the minimization of products and waste, the classification of waste streams, their collection, transfer, treatment and disposal. The management interface between departments is liable to many problems. For instance, the MW source control will directly decide on MW quantities and on scale adaptability of disposal facilities. The classification of MW will have great impacts on subsequent disposal methods. Illegal affairs are liable to occur in the collection and transfer of MW, and thus could result in the unregulated dumping of MW. The fly ashes produced in the incineration process have a high content of PCDD/PCDF and also other kind of solid or liquid residues. This can show some considerable contamination if they are not treated properly and can have a severe environmental impact. Therefore, the effective way of disposal can only be achieved by integrating operations among all the departments concerned.

88. There is an urgency to carry out a batch of BAT/BEP demonstration projects in representative MIs and dedicated disposal facilities. In this regard, it is required to exert control over design, equipment, engineering, operation and standard, introduce foreign advanced technology and equipment and absorb foreign state-of-the-art experience in operation in order to achieve acceptable release, to meet BAT/BEP requirements and to provide demonstration for the design, modification (or construction) and operation of other existing and new facilities. Considering the existing types of facilities and the future development trend, demonstration should cover the following:

- BEP application to MW management in MIs
- BAT/BEP application to centralized disposal of healthcare by incineration in rotary kiln
- BAT/BEP application to MW incineration in pyrolysis furnace
- BAT/BEP application to high-temperature steam disposal of MW
- BAT/BEP application to other non-incineration technology for centralized disposal of MW
- BAT/BEP application to MW disposal in remote rural areas
- Integrated BAT/BEP demonstration of MW disposal
- Cooperative/coordinated treatment of MW among dedicated MW disposal facilities

Demonstration of BEP application in MIs

89. Though most of the MIs in China have established a MW management system, formulated procedures for MW management and carried out certain training courses, there are still some significant gaps compared to the requirements of BEP. Surveys found that the following problems generally exist within a MI concerning the management and disposal of MW:

- Lack of necessary facilities and equipment for MW as required.
- Physicians and medical staff lack of sufficient knowledge about classification of wastes and have unclear information about the categories of MW. MW is mixed into domestic waste as non-healthcare waste, causing damage to the environment and the society; or

non-healthcare waste is mixed into MW, thus increasing the amount of MW and the related cost for its disposal and leading to a dissipation of resources.

- Incomplete safeguard for the collectors of MW.
- Lax management of temporary storage site, with risk of loss of MW.
- No records or incomplete records are made on the handover between MIs and dedicated MW disposal units.
- Lack of standard disposal methods for classification and temporary storage of waste containing mercury, most of which is burnt together with the infective waste. There are also no good methods for the disposal of used chemical reagents and chemical disinfectants, most of which are discharged into the sewage treatment system of the hospital.

90. Besides the existing problems previously described regarding the management and operation of MW, another prominent problem is that a mechanism for the recovery of cost related to the management and disposal of MW in MIs has not been established yet.

91. According to the Regulations on Management of MW, MIs can include the expenses for disposal of MW in the general medical costs. However, in most parts of China, the expenses for MW disposal are totally paid by MIs themselves, thus resulting in a heavy financial burden to these institutions. In this situation, MIs try to decrease the cost for MW disposal. As a result, facilities and equipment for MW treatment cannot be upgraded on time and their quality cannot meet the requirements on MW management.

92. Moreover, problems also exist in the ways MIs pay disposal fee to MW disposal centers. In some areas, disposal fee are collected based on the weight of the MW produced by a MI, while in other areas, fee are collected based on the sickbed number. In the case of weight-based payment, management of the MW inside MIs should be strengthened; otherwise, in order to decrease the weight of MW, medical staff would be inclined to mix MW into municipal solid waste in sorting MW. In the case of sickbed based payment, because the payment is declined with the quantity or weight of MW, medical staff would be liable to classify non-healthcare waste as MW in sorting MW for their own convenience and for avoiding mistakes, which would magnify MW and consequently increase the cost for MW disposal, environment pollution and social burdens.

93. The problems mentioned above commonly exist in various hospitals, and might occur to a different extent. Especially, to meet the requirements of BAT/BEP, the existing MW management systems are likely to be adjusted and improved wholly or in part and relevant personnel also need to be re-trained. At present, no ready-made experience can be used as reference in this regard. Therefore, this project will select representative MIs for demonstration and promote the experience acquired in situ in the last period of the project.

Demonstration of BAT/BEP application in dedicated MW disposal facilities

94. The centralized disposal of MW in China started after the SARS outburst in 2003. The method of incineration was mainly applied and in the last period, non-incineration technologies were applied to a certain extent in a small number but with a growing tendency. Mainly domestic manufacturers provided incineration facilities and the design and installation of the facilities also relied for a large extent on domestic enterprises, resulting in an overall not high technological level. In addition, lack of automatic control in combustion process and poor performance also contributed to a high pollutant emission from incineration facilities, generally much exceeding the limits. Moreover, the design scale of incineration facilities generally on the high side, plus ineffective collection of wastes, made incineration facilities unable to operate under optimized conditions. The lack of sufficient wastes for a continuous feeding resulted in frequent startups and shutdowns of incineration facilities, thus increasing possibility for the formation and emission of PCDD/PCDF.

95. Non-incineration technologies by definition have no PCDD/PCDF emissions. Non-incineration facilities are mostly imported from abroad and have a relatively higher technological level. However, facilities completed still have a series of defects, such as incomplete automation and non-closed system for material feeding due to the lack of regulatory standards for facility design and construction. Some autoclaving and microwave disposal systems show volatile organic compounds (VOCs) and malodor emission problems and some equipment requires manual operation in disposal and additional shredding device for final MW disposal.

96. As far as the hospitals and clinics at the township level and in ordinary cities at prefecture level, and the MIs at the county level and in remote rural areas are concerned, the MW produced generally can not be fully collected and disposed of in a centralized manner. The proportion of uncollected MW differs from one city to another, averagely accounting for about 15% of the total. Most of this portion of MW is disposed of by unsophisticated incineration directly in the generation site. Generally, the larger a city's area is, the more serious the problem will be. In remote and rural areas, with a lower education level, people have a limited knowledge of the hazards associated with MW, and are exposed under greater risks. When open burning without any control measures is used as a simple disposal method, PCDD/PCDF emissions are generally thousands times higher than acceptable standards.

97. While currently the NPHMW only requires the collection and disposal of MW produced by hospitals at the county level and above, it will pay attention to the MW collection and disposal in remote rural areas and at the township level in a later stage. At present, however, there is no definite plan for MW issues on layout, location selection, construction, technology, charge, collection, transportation and disposal for the MW management in rural areas. Therefore, demonstration of this project will provide valuable experience for China's Phase II work of MW treatment with regard to MW treatment in remote rural areas, in many aspects such as layout, technology, finance and policy, will energetically promote the development of work of Phase II, and set a guiding framework for the allocation of funds.

Demonstration of cooperative disposal of MW

98. With the aim to complete the construction of MW disposal facilities across the country as fast as possible and to set up a suitable framework of administrative rules, the NPHMW defined the scheme for the construction of disposal facilities focusing on incineration technology in cities at the prefecture level. In addition, the Program during its implementation has put in its agenda the construction of high-temperature steam autoclaves and other non-incineration disposal facilities and has foreseen as key point the disposal of the portion of wastes that cannot be treated and of the residual waste coming from this kind of treatment, pointing out that, the cooperative disposal of different types of MW must be evaluated with demonstration projects.

99. Even for MW incineration facilities, there is a portion of hazardous wastes produced by hospitals that cannot be disposed of effectively. The incineration equipment must have a certain period of time for revision and maintenance, while it is neither economic nor scientific to establish two lines for disposal of MW to solve the problem. In the event of an epidemic situation in a region, MW disposal facilities of the region would face difficulties in the disposal of a strong increased amount of MW and it would be more practicable to dispose of the increased MW in the adjacent regions. All these problems can be solved by strengthening cooperation with the regional hazardous waste disposal centers.

100. The cooperative disposal of healthcare waste involving disposal facilities in adjacent cities can have significant benefits. Apart from the economies of scale and the breakdown of administrative barriers, the concept reinforces regional planning and coordination. At a practical level a regional cluster of facilities including incineration and non-incineration technologies that can deal with the various waste streams of MW may provide an ideal model to improve environmental benefits and to ensure environmental safety within the region. The integrated

capacity of the regional cluster allows for the maintenance time without loss of service, the capacity to deal with a variety of specialized hazardous wastes and an enhanced capacity to deal with disease epidemics.

101. Another key point to be considered is the scale effect. Since capital and operating costs are inversely dependent by the scale, it would be advisable to apply the advanced technology in a large plant selected as demonstration project, in order to facilitate the maintenance of continuous operation and reduce the emission of pollutants. Therefore, from the scale effect point of view, adjacent regions should be encouraged to construct disposal facilities together.

102. Following the NPHMW, cities can select and adopt different disposal technologies according to the MW outputs and economic development level in their own areas. Diverse choices among different cities can create favorable conditions for the cooperative disposal of MW among the cities. For example, pathological and infectious sharps produced by a few cities without incineration facility can be stored, collected and transported to an adjacent city where there is an incineration facility for health care disposal, instead of installing two lines of incineration and non-incineration establishments in each city. However, in the past, due to economic problems, low investments and partial benefits, the setting up of an integrated plan for the construction of disposal facilities has not been carried out, and consequently municipalities tend to build small but complete treatment facilities on their own. Therefore, this project will select one or two representative provinces to develop the demonstration on the cooperative disposal of MW, with the aim to provide other provinces with the experience gained in applying such methods.

103. As mentioned above, the promotion of the cooperative disposal of MW has multiple economic, social and environmental benefits. However, to achieve these benefits, it is required to remove the present administrative barriers to establish a regional cooperation mechanism aiming at overall optimization of the facility resources in the region. A replication program should be put in place to promote on a large scale the mechanism nationwide based on the experience gained from demonstration projects, and thus achieve the goal of the safe disposal of MW more effectively and economically.

Lack of techno-economic policies promoting adoption of BAT/BEP in match with a market economy context

104. The technical policies for environmental protection are technical guidelines formulated by the government to guide industries to take self-regulatory actions in choosing and upgrading their technologies in light of the principles of sustainable development. BAT recommended by the Convention should be incorporated into a country's technical policy.

105. The economic policies for environmental protection are economic instruments including but not limited to pricing, taxation, credit, and insurance designed to regulate or influence the behavior of market players with an aim at realizing the coordinated development of economic growth and environmental protection. The United Nation's Rio Declaration on Environment and Development clearly states that countries flexibly adopt economic policies to internalize environmental costs into the production and consumption processes. Economic incentives (for example, appropriate tax policy and pricing policy) can be introduced to promote compliance with environmental standards.

106. China promulgated in 2001 the technical policy for the prevention and control of pollution caused by hazardous wastes. This technical policy is applicable to technology selection for the total process of pollution prevention and control from the generation, collection, transport, segregation, testing, packing, recycle, storage, treatment and disposal of hazardous wastes, and can be used to provide guidance on the planning, project justification, location selection, design, construction, operation and management of relevant facilities. The policy specifies as follows in terms of MW:

- MW should be collected, treated and disposed of by type;
- MW should be disposed of in a collective manner;
- dedicated incineration facilities are recommended for disposal; and
- recycling and reuse of disposable medical devices are forbidden.

107. China promulgated relevant fee charging and taxation preference policies for the operation of hazardous wastes facilities. In November 2003, the NDRC, SEPA, Ministries of Health, Finance and Construction jointly promulgated the *Advice Concerning Implementing Fee Charging System to Promote Industrialization of Hazardous Waste Disposal*, which gives definite provisions on such issues as how to implement the fee charging system for hazardous waste disposal. Charges for MW disposal that missed the payment should be included in medical service costs by regulating medical service price.

108. But considering practical needs of the present MW management, there are still some deficiencies and defects in the setting of technical and economic policies. The provisions of the current technical policies purely promoting incineration as the best preferred disposal method are outdated and biased, which cannot comprehensively reflect the latest international trend, particularly the BAT/BEP requirements of the Convention. The policy prohibiting recycling and reuse of disposable medical devices does not respect the principle of resource saving and recycling economy development.

109. The present economic policies for environment protection are not complete and fail to bring their roles into full play in promoting the market-based operation of MW management and disposal. Financial preferences in terms of tax reduction or exemption have not been clearly provided to reflect the public goods nature of MW disposal. In many cities, disposal costs have not been included in the service system of MIs, and the fee charging policy cannot be implemented practically. The government at various levels do not employ special funds, government subsidies and other economic incentives to encourage enterprises to carry out disposal of MW.

Lack of a certification and labeling program to provide open, reliable and comparable information on technical and environmental performances of MW treatment equipment for the disposal facility owners

110. The certification of environmental protection products (including MW disposal equipment) is conducted by an independent certification agency to certify that equipment used to prevent and control environmental pollution and instruments used specially for environmental monitoring comply with relevant standards or technical requirements. To carry out independent, objective and fair certification of environmental protection products has the following benefits:
    - Lift the market threshold for environmental protection products to prevent inferior products to enter the market so that users can choose and buy good quality products.
    - An environmental product manufacturer may promote the label issued by a certification agency among consumers to show and prove its products in compliance with related technical requirements. This helps to improve the environmental image of the enterprise and promote sales of its products.
    - The inspection and survey during the certification help to find defects and problems of the environmental protection product and urge the manufacturer to improve the manufacturing technology and product performance.

111. A complete organization system for the certification of MW disposal equipment should include an accreditation authority, an accredited certification agency and accredited testing institutes or laboratories.

112. At present in China, certification agencies accredited for certification of MW disposal equipment are China Certification Center of Environmental Protection Industry (CCCEPI) and China Standard Certification Center (CSC). CCAEPI is accredited by SEPA and Certification and Accreditation Administration of the People's Republic of China to carry out certification of environmental protection products. It can perform certification for 10 varieties of products for MW disposal including industrial waste incinerators and dust removal devices. CSC is subordinate to China National Institute of Standardization. It is a third-party certification agency accredited to carry out certification of products for energy conservation, water conservation and environmental protection.

113. Presently, 28 testing agencies such as the Quality Supervision and Testing Center for Environmental Monitoring Instruments under SEPA and the National Flue Gas Control Engineering and Technical Center of Environmental Protection Industry have been examined and approved by CCCEPI as qualified testing agencies. However, incinerator has not been included in their testing capacity.

114. Presently, in China there are over 60 manufacturers/providers of health-care disposal equipment including incinerators, autoclaving disinfection equipment, microwaving disinfection equipment, autoclaving-microwaving combined disinfection equipment and dry chemical disinfection equipment. So far, only incinerators and a few types of dust precipitator have been included in the list of products subject to certification.

115. The certification of MW disposal equipment is voluntary. Many disposal equipment manufacturers/providers are unwilling to apply for certification of their outdated manufacturing technology. High cost associated with certification and annual inspection is also an important reason. As of end of 2006, no medical waste disposal equipment has been included in the list of 281 types of products announced by CCCEPI that have been listed in the certification catalogue. Thus, the disposal facility owners cannot but buy products that have not undergone certification.

116. On the other hand, most MW disposal facility owners cannot fully understand the significance of buying certified equipment. To reduce purchase cost, they generally choose to buy cheap equipment that cannot meet the certification requirements. For facilities currently in operation, great majority have significant quality problems. For examples, most pyrolysis furnaces cannot operate in an uninterrupted way; the quenching tower cannot be installed and run; equipment service life is extremely short. These have severely affected effective operation of disposal facilities and make them difficult to achieve the safe disposal of MW.

117. In order to establish a certification and labeling program for MW disposal equipment, the following work has to be undertaken:
    - Develop technical requirements for the certification of MW disposal equipment;
    - Strengthen the existing certification agencies to include MW disposal equipment into their certification catalogue;
    - Develop certification procedures and criteria;
    - Strengthen the existing testing agencies to include MW disposal equipment into their testing catalogue; and
    - Encourage the manufacturers to apply for the certification and promote the facility owners to buy certified equipment.

Lack of commercially available options for diversified investment and professional operation in MW treatment and disposal facilities

118. As a country with a large of population of more than 1.2 billion, China produces a huge quantity of MW. In 2002, China produced 650,000 tons per year of MW or 1,780 tons a day. With the increase in population and MIs and the improvement of medical conditions, the quantity of MW takes the trend to increase year by year. It is estimated that the MW production will be about

680,000t in 2010 or 1870t/d. If disposed of improperly, these MW would be prone to cause significant environmental and health concerns, which objectively creates the requirement for the safe and environmentally sound treatment and disposal of MW.

119. The series of policies and laws issued by China put forward the market-based operation requirement for China's MW disposal industry, which helped to create the MW disposal market objectively. If estimated according to the Advice Concerning Implementing Fee Charging System to Promote Industrialization of Hazardous Waste Disposal and to the price of 2 RMB for each bed a day, a sum of 2.0 billion RMB MW disposal fee can be levied each year in China.

120. The MW disposal market consists of two segments, namely: (i) the market of MW disposal equipment, and (ii) the construction and operation market of dedicated MW disposal facilities. This project excludes the segment of managing MW with medical and sanitary institutions, which is generally considered non-commercial and operated as an obligation of medical institutions. In China, the transportation of MW generally falls into the responsibility of operators of dedicated disposal facilities, which should employ dedicated MW transfer vehicles for this purpose.

121. The NPHMW proposed to construct more than 300 dedicated disposal facilities in cities at municipal level and above. Since the Program has not listed about 300 remote counties into the coverage of these dedicated disposal facilities, some small-scale disposal facilities beyond the Program would be constructed in the future. It is thus estimated that the total value used for purchasing the disposal equipment needed by these facilities will reach about 5.0 billion RMB.

122. Presently, there are about 60 MW disposal equipment providers/manufacturers in China. Of these manufacturers, only few can produce main-body equipment and many can only produce auxiliary disposal parts. Besides, the manufacturing technologies are generally outdated, and the vast majority of disposal equipment manufactured has not passed or cannot pass certification. This situation indicates that it will be difficult for the domestic MW disposal equipment providers/manufacturers to provide adequate reliable equipment to meet the current and increasing needs of equipment for the MW disposal in China.

123. The construction and operation of MW disposal facilities require large sums of funds. Presently, China's construction funds of MW disposal facilities are mainly invested by the central government. According to the requirements in the Program, to construct the planned of more than 300 dedicated disposal facilities for MW, an investment of 6.89 billion RMB is needed. The central government is committed to allocate national debt funds of 30%, 60% and 75% of the total capital cost of facility construction as subsidy respectively to the Eastern, Central and Western cities of the country considering the economic difference among them, and the rest is provided by local governments or other sources as counterpart funds. Up to the end of 2006, the NDRC had approved 60 construction projects of MW disposal facilities, with 0.42 billion RMB national debt funds granted and 0.28 billion RMB leveraged as counterpart fund.

124. The construction of MW disposal facilities has also attracted some investment of private capital mainly by the adoption of the building-operation-transfer (BOT) model in regions with relatively more developed economy. There are 21 disposal facility construction projects taking this model to absorb private capital, such as Nanchang MW Disposal Center in Nanchang, Jiangxi Province and Jinan MW Disposal Center in Jinan, Shangdong Province. However, the MW disposal industry is featured by huge investment with only meager profit for public goods. Unless the MW disposal charging system is really carried out, it will be difficult to attract further private capital investment in the construction and operation of dedicated disposal facilities for MW.

125. Presently, dedicated disposal facilities for MW in China are operated in three ways:

(i) publicly owned run: In the publicly owned and run operation model, the government invests in the construction of a MW disposal facility, and the operation is managed by a state-owned

enterprise. Since the MW disposal is for public goods, it is taken for granted for the government to play a leading role in the construction and operation of such facility. This is particularly witnessed by many dedicated disposal facilities adopting this operation model in China because it started the collective MW disposal only after the SARS. However, this model does not respect the law of market economy. Due to the lack of competitive mechanism, the operation efficiency of the facilities is generally low.

(ii) publicly owned but privately run: In the publicly owned but privately run model, there is a well balanced public-private partnership established between the government and the enterprise. The government transfers, through a leasing or trust contract, the responsibility for the operation of and new investments in a publicly-owned MW disposal facility to a private enterprise that will undertake the investment, management, profitability and commercial risks of the facility operation. Typically, this model can be applied by ways including but not limited to the following:

- BOT: The government and an investor enter into a contract, under which the project company established by the investor will finance, build, possess, operate and maintain the facility, recover investments and gain reasonable profits by collecting service charges within the contract term. At the expiration of the contract, the facility in sound operation condition should be transferred to the government unconditionally.
- Quasi BOT. The main difference between quasi BOT and BOT is, under quasi BOT, the government is one of the shareholders of the project company.
- TOT (Transfer-operation-transfer). The government, based on the assets assessment of a dedicated disposal facility for MW built by the government, transfers the assets and grant franchise rights to an enterprise through public bidding, and the investor will operate as per BOT after its possession of the facility and franchise rights.

The main advantage of this model is to help raise funds for building and operating a disposal facility and improve the operation efficiency, while the major disadvantage of the model is higher requirements on the government's capacity for employing market instruments. If the contract between the public and private sides is not legally defendable, it is liable to cause disputes in such aspects as operation management and returns of investment; and consequently, the facility management and operation will be affected. As a result, this model has not been widely applied nationwide, though it is ideal to take this model under the context of market economy.

(iii) privately owned and run: In the privately owned and privately run model, a private enterprise is totally responsible for the investment, building, and market-based operation of the facility. This model can reduce greatly capital investment of the government and is prone to highest operation efficiency. But private enterprises will be generally difficult to gain loans from banks for the large amount of investment in construction of a facility because banks generally consider the waste disposal industry as non-profitable if there is no guaranty provided by the government, while it is legally explicit in Chinese laws that the government can not provide guaranty for a private enterprise. In addition, because MW disposal involves public environmental and health interests and private enterprises are largely profit driven, the government should limit a private enterprise to completely own and operate a facility. Therefore, this model has only very limited applications in China.

126. The above analysis indicates that, although the MW disposal has a relatively large market demand in China and some meaningful practices have been exercised, there are still some significant gaps to close up in order to realize market-based operation of the MW disposal industry and achieve the goal of the sustainable management of MW.

127. Operation policy and management of dedicated disposal facilities for MW involve many administrative departments in charge of development and reform, environmental protection, transportation, finance, taxation, health, and pricing. Presently, there is a lack of effective

coordination mechanism, which has caused many problems in the construction and operation of dedicated disposal facilities for MW in many regions. For example, in some cities such as Yuyao in Zhejiang Province and Pingliang in Gansu Province, it took more than two years for a dedicated disposal facility to finish the approval procedures with related administrative departments.

128. Many local governments have not put in place preferential policies in business tax, corporate income tax and other taxes in terms of the operation of dedicated disposal facilities for MW, nor do they have policy granting preferences to road and bridge toll for transportation of MW. And in many places, the concrete charging policy on MW disposal have not really been put into effect.

129. There is a lack of diverse fund raising options for closing up the big capital gap of dedicated disposal facility construction. As described above, though the construction capital of MW disposal facilities are partially provided by the central government, there is still a large capital gap of billions of RMB to realize the objective of NPHMW. Presently, there is only a narrow channel to mobilize non-government capital mainly in the form of equity participation and BOT, the realized amount is seriously inadequate. Considering that the national debt funds will significantly decrease and investment priorities will be shifted to rural areas during the 11th Five-year Program period, options to mobilize sufficient non-governmental funds should be vigorously activated.

130. The balanced public-private partnership has not yet been well established in the MW disposal sector. As described among the operation models for MW disposal facilities, the publicly owned and run model is prevalently taken in China. Local governments play an important role in promoting and regulating the market-based operation, but many local governments do lack expertise and experience on how to operate BOT and the derivative models due to the short history of market economy operation in China. Generally, it takes a long time to prepare a successful PPP-based project, or a project shortly agreed comes up with many faults in the key issues such as price, return rate and supervision during operation.

131. The market-based operation of collective disposal of MW is still in its infancy in China. There is deficient experience both in channeling diversified investment and achieving professional operation of MW disposal. Although this project will engage international and domestic experts to provide needed technical assistance and trainings, which to some extent can solve the problem of experience deficiency, technical consultancy services will still be needed with regard to promoting diversified investment and market-based operation after the completion of the project on a continuous basis. Therefore, it is necessary to establish or support such service-oriented companies by the implementation of this project so as to ensure the sustainable delivery of such services.

Lack of effective personnel training systems to provide qualified human resources for BAT/BEP based lifecycle management of MW

132. Experience of developed countries proves that effective trainings are needed to improve managerial and operating personnel's capabilities in order to achieve BAT/BEP based lifecycle MW management. The Stockholm Convention requires each party to promote and facilitate training of workers, scientists, educators and technical and managerial personnel.

133. The lifecycle management of MW involves many segments from segregation, collection, storage, transfer, transportation, treatment and disposal. Particularly, facilities such as incinerators and autoclave equipment need to be operated by trained and qualified personnel to ensure the correct and safe treatment and disposal according to the defined standards, guidelines and specifications.

134. Trainings to technical and managerial personnel are also required by the MW-related regulations of China. However, an effective personnel training system has not yet been established. Most of

the operators of the disposal facilities are not trained and qualified, lacking knowledge and capabilities for the compliance with established or to-be-established procedures, the correct operation of equipment, emergency response, record keeping, reporting, etc. There is also a lack of requirements for regulating the training institutions, trainers and trainings. There is a paucity of materials and programs for the personnel training in this field.

Lack of effective mechanism to promote research, development, and application of technically feasible and locally affordable processes, techniques and equipment (BAT)

135. Some researches about the disposal of MW received international financial assistances. For example, the Institute of Hydrobiology (IHB), Chinese Academy of Sciences (CAS) received funding from the Volkswagen Foundation and established China's first dedicated laboratory complying with international standards for the testing and research of PCDD/PCDF-like compounds; the US Trade and Development Agency provided financial assistance to the project "China National Technical Assistance for Autoclaving Treatment of Hazardous Wastes"; China and Germany launched the project "Technical and Economic Analysis and Research on the Application of Non-incineration MW Treatment Technology in China".

136. At present, there are about 30 enterprises, scientific research institutes and universities that are undertaking the research and development of technologies and equipment for MW disposal. Overall, China's research and development in MW processes, technologies and equipment mainly focus on incineration technologies, particularly the pyrolytic incineration technology, and there are few studies on non-incineration technologies.

137. However, the centralized disposal of MW has started recently in China, and the country's capacity for research and development on disposal processes, technologies and equipment is weak. The project preparatory phase surveys found the following gaps in incineration technologies of China compared with the international advanced level:

- The automation level of incineration disposal facilities is low in the waste feeding system. Many facilities are incapable of automatic feeding, resulting in poor sealing at the feed inlet;
- Both the furnace body design and the manufacturing technology of rotary kilns and pyrolytic furnaces are not up to standard. Furnace walls are frequently in a state of high temperature, which consequently damages the sealing of incinerators, affects temperature control and severely shortens the service life of furnace body;
- The state of pyrolysis and combustion is not stable enough. The automatic control system cannot take in time changes in response to the fluctuation of combustion conditions;
- The design of the principal body and nozzles of the quenching tower is inappropriate, which influences the effect of quick quenching;
- Design technologies for selective catalytic reaction equipment and catalysts associated are still missing in China;
- The continuous emission monitoring system (CEMS) is not up to standard, incapable of real-time monitoring of pollutant releases in the process of combustion; and
- Poor integration of related individual technologies into system.

138. China's research and development in non-incineration technologies for the disposal of MW is still in its infancy and, compared to foreign advanced technologies, has the following obvious gaps:

- Inadequate control on releases of VOCs, odors and other waste gases in application of non-incineration treatment technologies;
- Poorly designed shredders;
- Lack of automatic equipment to sort materials for recycling; and

- Poor integration of related individual technologies into system.

139. With the technological gaps in incineration, China cannot fulfil the BAT/BEP achievable emission technically for PCDD/PCDF from the MW incinerators, which this emission from the MW incineration disposal should be below the standard value of 0.1ngTEQ/Nm^3. The severely inadequate supply of various non-incineration technologies makes it difficult to adopt the alternative methods to incineration as recommended by the Convention. Therefore, China needs to properly introduce, digest and absorb foreign advanced technologies to close up these technological gaps. A long-term strategy on independent or joint research and development to ensure that equipment in demand is locally available, thus reducing costs for the implementation of the Convention.

140. Based on the above analysis, it is estimated that USD 50 million will be needed to make the needed technologies locally available and affordable. A strategy should be put in place to mobilize the needed fund for research and development by means of:
    - Divert the investment of the national scientific research funds to the research and development activities of this project by establishing a policy dialogue mechanism with the fund management authorities;
    - Tap the resources from enterprises for the research and development of disposal equipment in need by creating and regulating the tremendous market; and
    - Encourage joint research and development among international technology vendors and domestic enterprises by establishing a mutually equitable benefits sharing mechanism.

Weak stakeholder awareness raising and education

141. The entire process of the environmentally sustainable management of MW in China involves the following three groups:

    i) Governmental personnel from related departments, whose role is to carry out effective regulation and management of MW treatment and disposal through regulatory, administrative, economic and other instruments.

    ii) Professional bodies and individuals: This group includes scientific and technological research personnel for MW treatment and disposal, medical device manufacturers, medical staff, MW disposal equipment manufacturers, and MW disposal facility operators. This group of personnel plays an important role in the environmental sustainable management of MW through their professional performance and service. For examples, medical staff could take effective measures to reduce generation of MW; and the operators of disposal facilities could deploy reliable equipment and correct operation methods to dispose of MW to reduce or prevent the secondary pollution.

    iii) General public: The general public after having developed or upgraded their awareness and knowledge about MW may be enabled to voluntarily take actions to reduce the generation of MW and perform public supervision over the treatment and disposal of MW.

142. Thus it can be seen that, whether or not these groups of people can play fully their roles can determine largely if the objective of environmentally sustainable management of MW can be achieved. To bring into full play their roles, these three groups should first and foremost have the awareness and knowledge about MW. However, their awareness and knowledge in this regard are currently inadequate.

143. Due to lack of knowledge about the secondary pollution from uncontrolled incineration of MW, many governmental management personnel wrongly believe that incineration is the best and most thorough way to eliminate hazards of MW. They actively promote incineration technologies and neglect the research, development and application of alternatives. As a result, inappropriate incineration disposal has generated considerable amount of toxic and hazardous substances like PCDD/PCDF causing severe secondary pollution.

144. Many professionals are also causing environmental concerns due to lack of sufficient consideration of environmental protection for MW disposal. Without a full understanding of the relationship between their products and the generation and disposal of MW, many medical device manufacturers use mercury and chloric polymers such as PVC when producing disposable medical supplies. Due to their insufficient awareness on environmental pollution, numerous medical staff reckons the incineration disposal of MW as a positive means. In remote rural areas, MW is even disposed of by means of open burning.

145. It is difficult for the general public to be informed on the safe disposal of MW. The governments or other agencies have not been effective in providing the general public with easy-to-understand information materials to disseminate knowledge about health and environment protection. Surveys found that children in rural areas often play with infected disposal syringes. Rag pickers usually dig out MW at landfills for resale. These behaviors are extremely likely to cause the spread of such infectious diseases among themselves and the public. In addition, the general public will not automatically support the fee charging policy and actively participate in the public supervision over the safe disposal of MW.

146. China has carried some public information and educational activities to address the present situation of the general public's weak awareness on health and environment protection associated with MW. Some professional books or materials like MW Management and Pollution Control Techniques are published, but they are few in variety and incomplete in content. Popular public information materials for non-professionals (for example the general public) are even more inadequate. Some domestic websites provide introductory information about the treatment and disposal of MW but not in a systematic manner. Very few formally planned public information and educational campaigns have been carried out through radio, TV, or other effective means.

147. The public information and education on environmental protection from MW is an important instrument to fulfill the objective of the environmental sustainable management of MW. During the implementation of this project, materials in various forms of brochure, post, books, academic journals, and TV and radio programs will be developed and disseminated through effective media to raise the awareness of stakeholders in expectation of change of behaviors.

1.3 Local, Regional and Global Benefits

148. Like other POPs, PCDD/PCDF is a class of toxic chemicals that resist degradation, bio-accumulate and have the potential for long-range transport and therefore their exposure can harm human health and ecosystems at locations nearby the site from which they escape into the environment and also at very far distances from that site and can impact adversely on wildlife, aquatic and marine life, domestic animals and humans. Due to their unique properties, POPs do not respect national boundaries, and therefore pose a special kind of challenge that makes it impossible for any one-nation acting alone to remedy the problems and hence global action is warranted.

149. Many well-established studies confirmed that PCDD/PCDF is a cancer hazard to people. In addition to cancer, exposure to PCDD/PCDF can also cause severe reproductive (such as decreased fertility and reduced sperm counts) and developmental problems such as birth defects, inability to maintain pregnancy and lowered testosterone levels. PCDD/PCDF is well known for its ability to damage the immune system, interfere with hormonal systems, lung problems and skin disorders.

150. The BAT/BEP based lifecycle management of medical waste has not yet been achieved in China. According to the statistics, about 18,000 MIs will be producing around 680,000 tons medical waste per annum by 2010, among which only about 1/3 are collected and transported to centralized disposal and about 2/3 tons are either mixed into the domestic wastes or circulated

into the society as raw material. According to the NPHMW, about 85% MW should be subject to collective disposal.

151. The collected portion of MW is generally disposed of in incinerators where no effective APCDs were installed to control the release of air pollutants such as particulate matters (PMs), PCDD/PCDF, heavy metals (Pb, Hg and Cd), acid gases (HCl and SO_2), CO and NOx, which can cause serious adverse impacts to workers' safety, public health and the environment.

152. In the scenario where MIs will adopt BEP for MW lifecycle management, benefits can arise from the reduction or elimination of MW into the domestic waste stream or the exposure of society to risk and thus enhance the protection and safety of the workers and the public. BEP applications can reduce production of waste at source and use of single-use devices and products containing hazardous materials such as mercury by promoting safe reuse and recycling and, for example, replacing mercury-based diagnostic tools with digital and electronic technology. BEP applications by the MIs can also avoid administrative or legal liabilities arising from non-compliance with the related regulations.

153. Through the application of BAT on existing and new MWIs, this project could achieve significant reduction of air pollution emissions caused by poor combustion and absence of necessary APCDs such as activated carbon tower, filter fiber, and dry or wet scrubbers, etc. BAT will also be applied to replace outdated incinerators with alternative MW treatment technologies such as autoclaving and microwaving, which can totally avoid formation of PCDD/PCDF. In applying these alternatives, emphasis will be put on the sterilization efficacy and volatile organic compounds (VOCs) emission control to ensure the safe disposal of MW.

154. Thus, this project will be able to generate significant local, regional and global benefits as follows:
    - Local benefits include reduced cases of cross-infection by infectious MW and injuries by sharps, and reduced exposures of local population through inhalation of airborne emissions.
    - Regionally and globally the importance of the project cannot be overstated as it directly impacts on the safe management of MW generated by more than 25% of the global population.
    - The project necessarily addresses the issue of infection control in the Chinese Health Care Sector and builds on the positive platform already established for the management of SARS, the control of which has a global significance.
    - The proposed structured approach to MW management constitutes preventive management and reduces the risk of the future outbreaks of infection, which could have international consequences in a globalized environment.
    - The project addresses the reduction of PCDD/PCDF and other POPs releases into the atmosphere, the reduction of which is a global priority.
    - The project will address the measurement and quantification of MW waste generation and disposal including the quantification of pollutant releases. These management tools provide a basis to verify international environmental treaties and to communicate with the international community.

1.4 Special Features

155. This project is the first one in China to explore and apply BAT/BET to substantially reduce and eliminate releases of UPOPs. According to the control strategy for UPOPs, China will also cooperate with other agencies such as the World Bank and UNDP to develop and implement a number of release reduction programs for other key industries. The innovation, experience, lessons learned, models and outcomes of this project can inform and reference other planned emission reduction programs.

156. This project is a national priority and is cost effective. MW incineration, listed among key release sources in Part II Annex C of the Convention, has high priority in terms of emission reduction. According to the definitions of new and existing sources under the Convention, MW incineration in China includes both new and existing sources. This project will apply BAT/BEP to new sources in the sector and then extend the experience and model achievements to the existing sources. The analysis and evaluation results show that, a total reduction by 99.9% of PCDD/PCDF releases can be achieved based on the technological path of this project. The project will also create a broad range of co-benefits enabling it to be highly cost-effective.

157. Geographically, this project covers the whole country. China has a vast territory and the level of economic development and environmental protection differs considerably from one region to another. Because of the diversity of situations applying to each potential centralized MW facility, the preparation of this project must be sensitive to the economic affordability and technical support capability of different regions and BAT/BEP promotion cannot be carried out in a 'one-size-fits-all' approach. Thus, in order to be successful, this project must generate a generalized model that can demonstrate principles and can be replicated in varying social, geographical and economic conditions.

158. A great variety of stakeholders involved in the total process of MW management include ministries such as health, environmental protection, finance, planning and other government departments, institutions such as technological research and development service sectors, manufacturers of medical supplies and disposal equipment and waste disposal units. MW generation involves each and every citizen to implement the "polluter pays" principle, which requires recognition and support and each will benefit from sustainable environmental management of MW. Accordingly, the total process management system for MW that this project will establish must take into consideration the roles of all stakeholders including individuals and through an appropriate mechanism, mobilize them to participate in the implementation of this integrated system.

2. RATIONALE FOR GEF INTERVENTION

159. The strategy proposed by the National Implementation Plan (NIP), sectoral Action Plan, and this proposed Project for the medical waste sector includes efficient operation of incineration technology and increased reliance on non-combustion bio-hazard sterilization technologies, supported by necessary capacity building and regulatory framework strengthening and consistent with the BAT/BEP guidelines and guidance. The project also promotes development of an industrial and service sector providing support to medical waste management, and encourages a market-led policy. This planned approach also accommodates China's obligations under the Stockholm Convention to reduce the current 11.5% of PCDD/PCDF releases attributed to the medical waste sector.

160. Historically, the Chinese healthcare system produced a comparatively low level of actual MW but the absence of effective infection control measures created an environment where the risk of infection was endemic.

161. To address this issue and to reduce the probability of in-hospital secondary infection of patients, China started in 1987 to introduce overseas successful experience and promote the use of disposable single use medical items in MIs. In the past two decades, both the variety and the quantity of disposable medical apparatuses used in Chinese MIs and related units have increased rapidly. The characterization profile of Chinese MW is rapidly converging to the western profile.

162. The outbreak of SARS in 2003 exposed significant shortcomings in the infection control practices and environmental management of medical waste in China. The Government of China responded to the public health crisis at three levels:

- Immediate commissioning of 70 quick-response temporary incinerators;
- Preparation of a plan to establish 332 dedicated medical waste disposal facilities throughout China; and
- Issuance of emergency regulations to control SARS-like biological hazards.

163. While these measures were viewed as crucial to combat the SARS crisis, they were developed and implemented in an emergency context. Therefore, China was unable to develop a comprehensive system to manage medical waste, along with the individual, institutional and policy capacities to make it work. The National Plan for Hazardous and Medical Waste issued in 2003 was however developed prior to China's accession to the Stockholm Convention.

164. In February 2006, non-incineration technology specifications including chemical disinfections treatment were issued by SEPA. *(Ref: Technical Specifications for Chemical Disinfection Centralized Treatment Engineering on MW. HJ/T228-2006)*. At the same time, technical specifications were issued for the treatment of MW using microwave treatment. (*Ref: Technical Specifications for Microwave Disinfection Centralized Treatment Engineering on MW HJ/T229-2006*). And in August 2006 technical specifications were issued for the treatment of MW using steam based treatment. *(Ref: Technical Specifications for Steam Based Centralized Treatment Engineering on MW HJ/T335-2006)*.

165. The development of these specifications, although still in draft form provide a basis to divert MW from incineration to non-combustion treatment thereby reducing the unintentional release of POPS and contributing to compliance with the terms of the Stockholm Convention.

166. Moreover, other globally harmful contaminants generated by the MW incineration, such as hexachlorobenzene (HCB), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAH) and heavy metals can be reduced for little or no additional cost, since many

of the measures to reduce PCDD/PCDF emissions can simultaneously reduce emissions of these micropollutants as well as CO_2 and SO_2.

167. By the efficient segregation of MW the mercury content of the waste to be incinerated would be minimized. The same techniques used for PCDD/PCDF removal in incineration plants can be applied for mercury reduction. Particular care must be paid in temperature control and optimization of abatement devices themselves and some additional precautions should be evaluated, such as the introduction of oxidative additives or active carbon containing sulphur, in order to convert metallic mercury in the chlorinated form.

168. In order to reduce the amount of waste contaminated by mercury and avoid its emissions, proper segregation at hospital level and disposal with dedicated chemical process are essential. This coupled with BEP measures targeted towards the substitution of medical instrumentation containing mercury (as thermometers and manometers) could be applied.

169. For any non-Stockholm Convention globally harmful contaminants identified and addressed by the project, GEF support could be justified under International Waters Contaminant Based Operational Program (OP) 10, and/or other related OPs, as undertaken by the UNDP Global Project for Demonstrating and Promoting Best Techniques and Practices for Reducing MW to Avoid Environmental Releases of Dioxins and Mercury. However, activities related to mercury reduction may require additional costs that will be covered by co-financing and not from the GEF grant part of the project budget.

170. Properly designed and implemented management systems for incineration operation also contribute to the reduction of solid residues from the incineration process and the associated costs of post-treatment methods (landfilling or others).

171. Heavy metals, PAHs and PCDD/PCDF can be found at levels of the order of ng/g in fly ashes or pg/g in other ashes. It must be pointed out that as pollution equipment becomes more effective in removing particulate matter, the toxicity of any kind of ash increases. This has environmental implications for the disposal method to be used. Even internationally, while the law often stipulates stringent requirements on handling of the ash, there is usually no clear guidance on its disposal. Some ash is treated as hazardous waste, but sometimes, especially in developing countries, they are disposed of as ordinary waste in landfills.

172. PVC plastic is the most widely used plastic in medical devices and can be harmful to patients, the environment and public health. Two key problems associated with PVC include the formation of carcinogenic PCDD/PCDF during the manufacture of PVC and during the incineration or burning of PVC products, and the leaching of DEHP (diethylhexylphthalate), a phthalate commonly used to soften PVC plastic, from PVC medical devices into patients. DEHP has been linked to reproductive birth defects and other illnesses.

173. Alternatives to PVC plastic medical devices are widely available on the market. There are many non-PVC materials available, suitable for a wide variety of medical applications, which do not require phthalates or other softeners. Furthermore, since the alternatives are not made from PVC, they can easily be recycled eliminating the problems associated with disposal of PVC medical equipment.

174. While the priority of the NPHMW was necessarily the management of infection and the tackling of the SARS outbreak, compliance with the Stockholm Convention was, understandably, of secondary consideration at the time.

175. In May 2001, the Stockholm Convention on Persistent Organic Pollutants (POPs) was adopted with the aim of protecting human health and the environment from POPs. The GEF became the principal financial mechanism by the decision of the Conference of Parties (COP). In October

2002, the GEF Assembly approved the addition of POPs as a new GEF focal area, and in November 2003, the GEF Council approved a GEF Operational Program on POPs – OP 14.

176. Article 13.2 of the Convention provides that developing countries Parties and Parties with economies in transition will have access to new and additional financial resources to enable them to meet the agreed full incremental costs of implementing measures that fulfill their obligations under the Convention. Therefore, insofar as a Party is obliged to require best available techniques under the well-defined circumstances specified in the Convention, the Party should receive access to the agreed full incremental costs of implementing this obligation.

177. Article 5 of the Stockholm Convention addresses measures that Parties shall take measures to reduce releases of unintentionally produced POPs listed in Part I Annex C with the goal of their continuing minimization and, where feasible, ultimate elimination. Part II of Annex C is a list of source categories that "*have the potential for comparatively high formation and release of these chemicals [i.e. dioxins] to the environment*" and the "Waste incinerators, including co-incinerators of municipal, hazardous or MW or of sewage sludge" is the first source in the list.

178. For the new sources listed in Part II, which includes any new or any substantially modified facility for incineration or combustion of MW, Parties are required to use best available techniques. This requirement is to be "phased in as soon as practicable but no later than four years after entry into force of the Convention for the Party." The Convention entered into force to China on 11 November 2004, which means that MW treatment facilities and systems constructed or modified on 10 November 2005 and beyond will be required to adopt BAT/BEP not later than 10 November 2008. Furthermore, in all existing facilities prior to the former date, China is required under the Convention to promote BATs and BEPs in due course.

179. Incineration of MW was listed in the Strategy to Reduce and Eliminate Releases of Unintentionally Produced POPs of the NIP as a priority source category. According to the Strategy, China shall apply BAT and promote BEP in new sources in priority source categories by 2008, and complete PCDD/PCDF release reduction demonstrations in selected existing sources in the priority sectors by 2010.

180. When a Party implements this obligation, it should assure that priority consideration is given to alternative processes, techniques or practices that have similar usefulness but which avoid the formation and release of chemicals listed in Part I of Annex C. Subparagraph (f) in Para. A Part V Annex C provides: "*When considering proposals to construct new waste disposal facilities, consideration should be given to alternatives such as activities to minimize the generation of municipal and MW, including resource recovery, reuse, recycling, waste separation and promoting products that generate less waste. Under this approach, public health concerns should be carefully considered.* "

181. As suggested in the final draft of the guidelines on BAT and guidance on BEP, possible alternatives to incineration may include sterilization (steam, advanced steam, dry heat), microwave treatment, alkaline hydrolysis, or biological treatment, each followed by landfilling. The most important step in managing Mw including waste minimization is segregating the different types of waste at the source. As between 75% and 90% of wastes in hospitals is comparable to municipal solid waste, segregation will greatly reduce the volume of MW.

182. Open burning of waste, including burning of landfill sites, is included in Part III Annex C as a source from which unintentional POPs may also be formed and released. In China's rural and remote rural areas the common practice of burning MW in open spaces should be banned.

183. Project activities that are consistent with GEF-eligible activities under OP 14 include: building MW management capabilities; strengthening policy and regulatory frameworks; strengthening monitoring capacity; developing capacity to assess technologies and management practices; developing and implementing public awareness, information and environmental education

programs; facilitating dissemination of experiences and lessons learned and promoting information exchange; promoting access to, and the transfer of, clean and environmentally sound alternative technologies; and demonstrating viable and cost-effective alternatives to the processes and practices that lead to the release of POPs.

184. Pursuant to the Strategy and Objective 2 in POPs focal area for GEF-4, GEF will strengthen and build the capacity required in eligible countries to implement their NIPs. Depending on NIP priorities, interventions can include strengthening regulatory frameworks, strengthening of human and institutional capacity, strengthening of monitoring and enforcement capacity, and raising awareness among various stakeholders. The capacity building components designed in this project are consistent with the aforementioned activities.

185. The GEF4 Strategy in POPs focal area also states that coordination and synergies with countries' responses to related multilateral environmental agreements addressing chemicals issues will be encouraged. The design of activities regarding BAT/BEP demonstration and replication has taken into account Technical Guidelines on the Environmentally Sound Management of Biomedical and Healthcare Wastes issued by the Secretariat of Basel Convention and other related guidelines issued by WHO.

186. The expansion and modernization of the Chinese healthcare system occurred within a very short transition period and there are gaps in the institutional capacity to design and implement effective infection control. The absence of an effective infection control management system affecting 25% of the global population is of international concern.

187. The GEF intervention can be justified as follows:

- Waste incinerator of medical wastes is an industrial source category that has the potential for comparatively high formation and release of unintentional POPs to the environment.
- While the response to the SARS outbreak was effective, it was a 'firefighting' response by applying incinerators without appropriate APCS. The project addresses the capacity and technological barriers to the implementation of the necessary management and technology systems with reference to best international norms and practices expressed as BAT and BEP inorder to assure reduction of releases from this source of unintentional production.
- Even the 2003 NPHMW addressed the specific issue of infection control and does not fully take into account the obligations of the Stockholm Convention. The project, by addressing the reduction of POPs generation from healthcare waste and the managed segregation and handling of MW streams, complements the NPHMW and integrates the country's obligations under the Convention.
- The application of BAT involves the prior hazard identification and environmental impact assessment and the application of appropriate non-combustion technologies to address the identified issues in their social, geographical, economic and cultural contexts. The planning, construction and operation of dedicated MW treatment facilities requires the application of regulatory controls including feasibility assessments, planning permits, environmental impact assessments and operating licenses. The project will demonstrate these regulatory controls in an integrated way and provide a basis for confidence generation with the international community. In this way, the project provides some defense against technology dumping.
- Infection control and MW management requires a closed circuit management system, which integrates hygiene, health, safety and environmental management systems across the total cycle of health care provision, waste collection, transportation, storage and disposal. This project addresses the gaps involved in the delivery of this integration.

3. PROJECT OBJECTIVES, OUTPUTS AND ACTIVITIES

3.1 Objectives

Overall Objective of the Project

188. The overall objective of the project is to reduce and ultimately eliminate the releases of unintentionally produced POPs and other globally harmful pollutants into the environment, and assist China in implementing its relevant obligations under the Stockholm Convention. The project is to interact with the Nationwide Investment Plan and promote the widespread adoption of BAT/BEP in the evolving medical waste management infrastructure and industry in a manner that reduces adverse environmental impacts and protects human health.

189. Conceptually, the overall objective will be achieved through combined strategies of reducing and modifying the materials to be disposed of, the optimization of incineration technologies, the introduction of non-combustion technologies, the raising of awareness and the dissemination of know-how, the incorporation of management systems, the innovation and adaptation of appropriate technologies and techniques, the integration of economic and financial systems and the enhancement of relevant laws and regulations. The project conceptual framework is given in Figure 1 below.

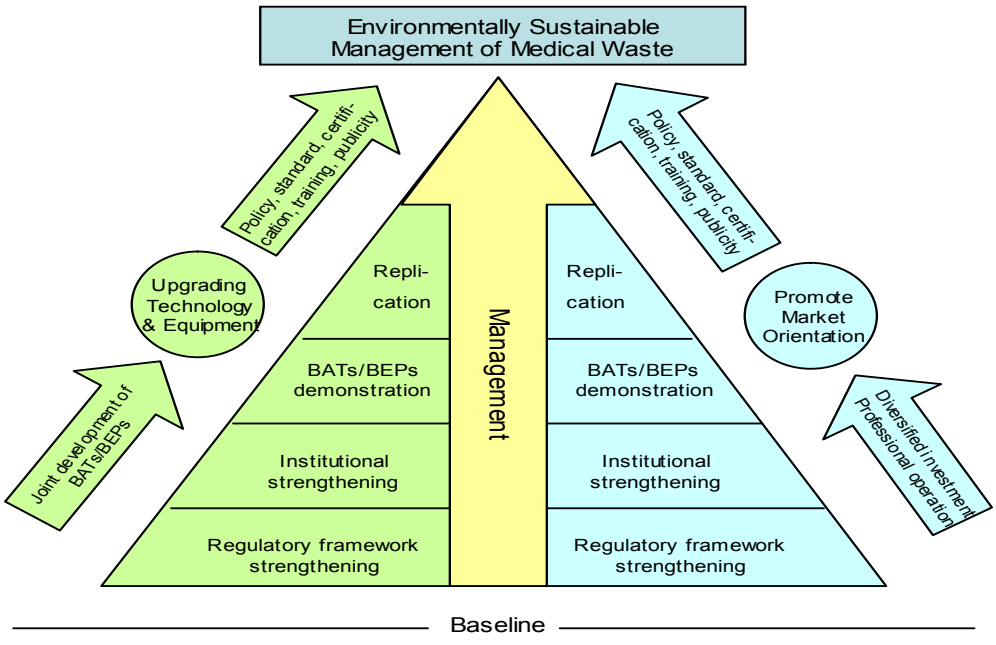

Fig. 1 Project Conceptual Framework

Immediate Objective of the Project

190. The immediate objectives of the project are as follows:

- Review, revision, and recommendation of appropriate changes of the regulatory and policy enabling environment.
- Institutional strengthening through the use of a targeted technical transfer activities to apply and disseminate BEP in the lifecycle management of medical waste.
- Application of BAT in six targeted municipalities within the project implementation period.

- Design and implementation of economic and financial systems that can sustainably support the medical waste management sector.
- Support for the development of an industrial base that promotes a precautionary and preventive approach to domestic goods, services and the appropriate adaptation of technologies.
- Identification, demonstration and promotion of appropriate medical waste management systems and technologies applicable to remote rural areas.
- Coordination of medical waste management with an effective transfer system in 3 targeted provinces.
- Formulation of a nationwide replication program to disseminate BAT/BEP as part of a national strategy and action plan.

191. There are 8 Outcomes designed to achieve the above objectives. The outcomes/outputs and the corresponding main activities are as follows:

Outcome 1 will strengthen the national, provincial, and local regulatory framework for medical waste management. Activities to be undertaken include the adaptation and application of laws and regulations relating to medical waste management and upgrading and establishing performance levels associated with BAT for medical waste disposal.

Outcome 2 will strengthen nationwide institutional capacity for integrated medical waste management at national and local levels in support of the Nationwide Investment Plan. It will establish a National Steering Group addressing all relevant institutions and stakeholders and through this coordination mechanism, the capacity for monitoring, supervision, and evaluation of medical institutions and dedicated medical waste treatment and disposal facilities of relevant authorities will be strengthened.

Outcome 3 will demonstrate systems management and application of BEP in 20 medical institutions covering such aspects as good procurement practices, waste segregation at source, waste reduction/minimization, reuse and recycling, intermediate storage, transportation, traceability and staff training.

Outcome 4 will demonstrate BAT for medical waste disposal using thermal combustion, including air pollution monitoring. One existing rotary kiln facility and two pyrolysis incinerators will be selected to test and verify BAT application and demonstrate reduction of PCDD/PCDF emissions to between 0.1-0.5 ng TEQ/Nm^3 within demonstrable management system structures that are designed to achieve continuous improvement over time. The Outcome 4 will be achieved by process improvement and process optimization as well as by introduction of monitoring (sampling and analysis), in other words no capital investment will be required from the GEF grant part of the project budget. Experience will be derived and summarized for wider dissemination of BAT in Outcome 7. These demonstration activities will also support the development of specifications for the engineering design and construction of such facilities by adopting BAT as well as operational safety.

Outcome 5 will demonstrate BAT/BEP for medical waste thermal non-combustion, chemical treatment or other appropriate non-combustion treatments that may also be suitable for remote rural areas. In order to demonstrate the replacement of incineration disposal methods, one autoclave facility, one microwave facility and one chemical disinfection facility will be procured and installed. The project will also promote the adoption of similar but smaller scale facilities appropriate for remote rural areas. Experience will be derived and summarized for wider dissemination of BAT/BEP in Outcome 7. In addition, these demonstrations will also support the development of specifications for the engineering design and construction of such facilities by adopting BAT as well as operational safety.

Outcome 6 will demonstrate spatially integrated and coordinated medical waste management and disposal systems in geographically defined clusters that include medical institutions and dedicated

treatment and disposal facilities. Integrated or life-cycle medical waste management among various institutions within a municipality of each of the three demonstration provinces will be demonstrated. Three provinces will be selected for the demonstration of spatially coordinated medical waste treatment and disposal systems incorporating a number of dedicated facilities within a defined area in a manner that is economically effective and efficient.

Outcome 7 will develop and formulate a national strategy and action plan of BAT/BEP for medical waste management and disposal based on the experience gained through the demonstration activities of the project. This project will also contribute to the national strategy and its implementation specifically through the following outputs:

- Formulation of techno-economic policies that promote the adoption of BAT/BEP;
- Demonstration and promotion of different commercial models (e.g. BOT, BOO, TOT, etc.) for the construction and operation of medical waste treatment and disposal facilities.
- Strengthening of national capacity to develop new medical waste treatment technologies appropriate to China's socio-economic context.
- Development and implementation of a medical waste treatment equipment certification and labeling program.
- Establishment of training and accreditation systems for lifecycle management of medical waste that support BAT/BEP.
- Extensive raising of stakeholder awareness, including a series of national and international workshops.

Outcome 8 will establish and utilize the necessary tools to facilitate effective monitoring and evaluation on progress of project implementation and achievement of results. A series of training programs will be conducted to improve the managerial and technical capabilities for effective project implementation and management.

Innovativeness of Approach

192. The project brings forward a number of innovations, which can be expressed as the creation of an environment that encourages the development of three mutually supporting pillars. Encouragement of the development of an industrial sector that is capable of supporting the project and the Nationwide Investment Plan. This implies access to the relevant technologies and the medium and long-term capability to maintain these technologies. The evolution of this support sector is predicated on the willingness of industry both indigenous and foreign to engage. Figure 2 identifies incentives and disincentives that may determine this outcome.

193. Similarly, the project is a catalyst for the development of a services support sector that can provide the necessary professional knowledge-based services that are critical to the management of the medical waste lifecycle from equipment procurement in the hospital through the delivery of medical and surgical services to storage, traceability, accounting, sampling, analysis, logistics, technology monitoring and validation, to name but a few of the potential services required. The incentives and disincentives that may determine the success of this sector are also indicated in Figure 2.

194. Both the supporting industries and services depend on the viability of the fee-based system and that is envisaged and described in Annex 2 of this document. The Nationwide Investment Plan will have a major influence on the industry support sector.

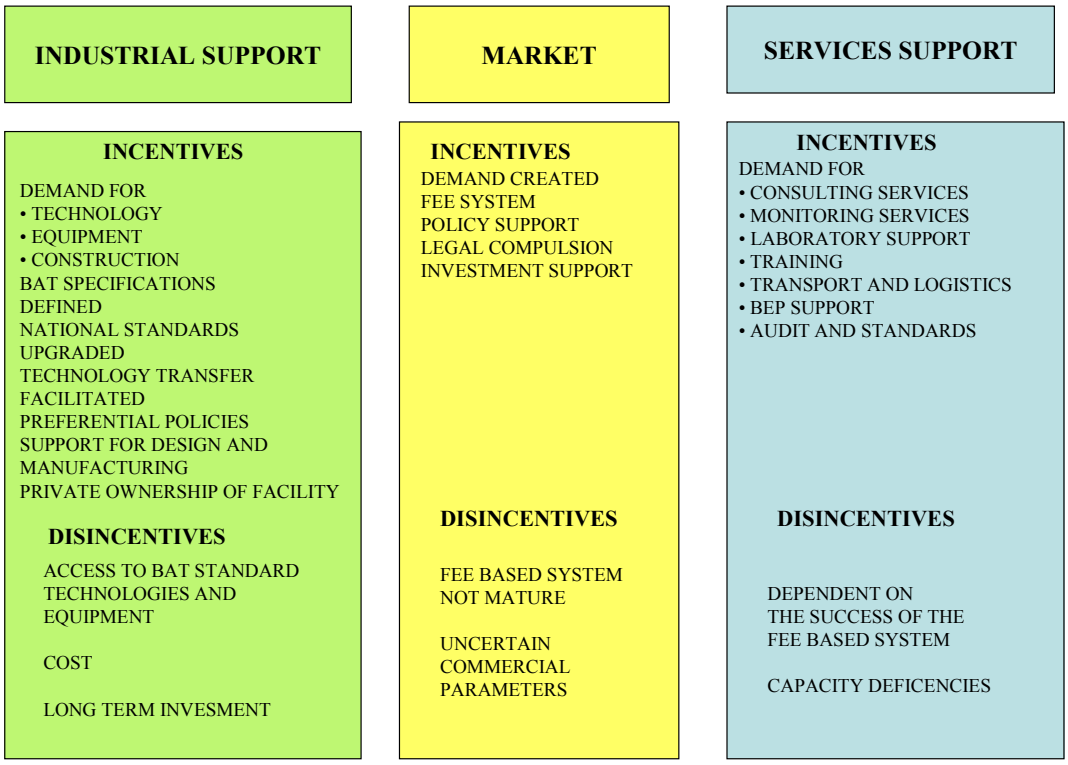

Fig. 2 Project Approach

Methodological Approach

195. Based on the extensive barrier analysis of medical waste management, treatment and disposal in China, the primary methodological approach to this project is determined to carry out the demonstration and replication of BAT/BEP in the environmentally sound management of medical waste to continuously reduce PCDD/PCDF releases by upgrading the incineration equipment and APCS to the BAT level and replacing outdated or over-capacity incineration facilities with alternative, non-incineration techniques that avoid the release of PCDD/PCDF.

196. To achieve the goal, the regulatory, administrative, planning, technical, economic, market, information and training instruments are designed and will be applied comprehensively during the implementation of the project to: (i) promote the locally affordable or commercially available supply of technologies and equipment needed and (ii) promote the commercialization of domestically constructed medical waste treatment and disposal facilities. This extensive capacity building program aiming at regulatory framework strengthening, institutional strengthening, and promoting local manufacturing industry and services will be carried out nationwide.

197. Given the fact that great differences exist in socio-economic, geographic, cultural and ethnic aspects among the eastern, central and western regions of China and between the densely populated urban areas of advanced development and remote, under populated and underdeveloped rural areas, no single model of BAT/BEP can govern the entire situation throughout the country. BAT/BEP needs to be modified, demonstrated and verified in different regions with particular reference to the specialization of the medical institutions, the type of dedicated treatment and disposal facilities, and the availability of relevant infrastructure and logistics. Therefore, one representative province will be selected from each of the region for a

meaningful cluster of demonstrations in applying BAT/BEP. The selection will partly be based on the experience gained through the countrywide capacity building program.

198. As described in Figure 3 below, a complete cluster of BAT/BEP applications will be adopted by medical institutions and dedicated treatment and disposal facilities within a demonstration province to achieve the optimal social, economic and environmental benefits. In the cluster, medical institutions will be assisted to adopt BEP in medical waste segregation and reduction at source as well as temporary storage and transfer to dedicated facilities. Dedicated disposal facilities, will keep the incineration and pyrolysis processes and PCDD/PCDF releases under optimal control to meet performance levels associated with BAT, while diverting a significant portion of medical waste to alternative processes such as autoclaving, microwaving, and chemical disinfection that avoid unintentional production of PCDD/PCDF. Coordinated treatment and disposal with an effective medical waste transfer system among incineration and non-incineration facilities will be planned and implemented at the provincial and regional level in the cluster to optimize the performance and functions of facilities in a fit-for-purpose and least costly way.

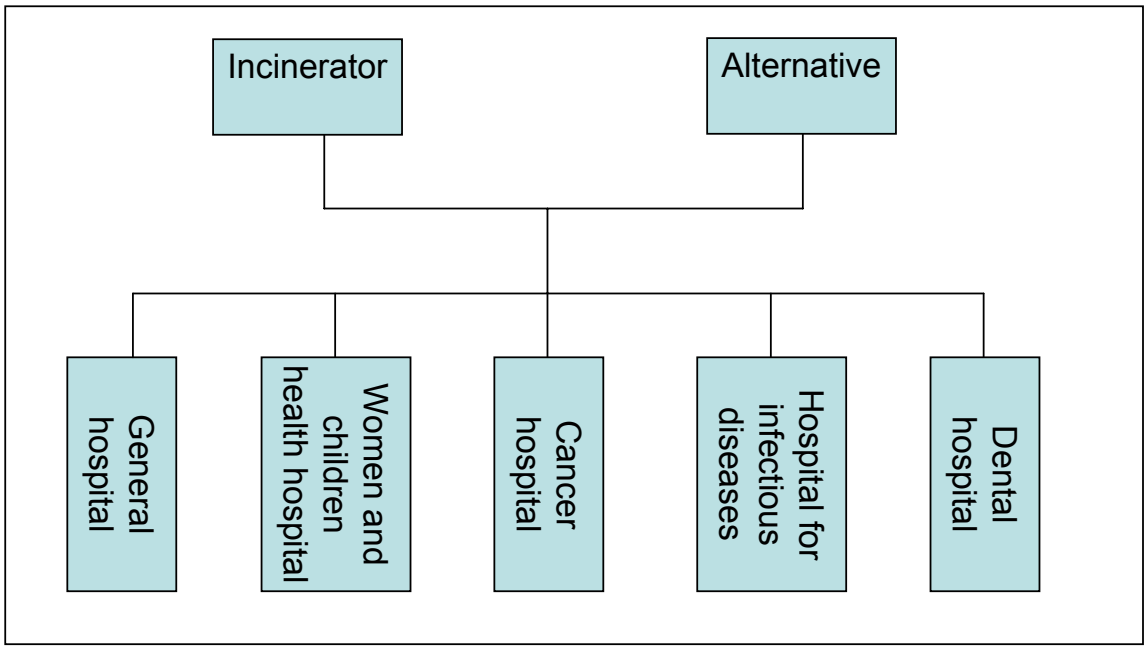

Fig. 3: Demonstration plan in a demonstration province

199. In order to avoid unnecessary duplication and achieve the highest cost-effectiveness, successful experience in applying BEP in medical institutions and establishing the complete cluster by coordinating related dedicated treatment and disposal facilities will be learned from the cluster demonstration in the selected province that can be replicated to other provinces in a regional context.

200. The dissemination of BAT/BEP applications using the cluster concept will be promoted nationwide. The project will deliver extensive trainings to enhance technical competencies and establish the personnel training system to disseminate the successfully demonstrated experience for environmentally sustainable medical waste management. Information will be widely and openly disclosed through a dedicated project website to facilitate the dissemination. Necessary administrative instruments will be taken and market based incentives will be fully brought into action to ensure the effectiveness and efficiency of the replication program.

3.2 Outcomes, Outputs, and Activities

201. According to the above-mentioned methodological approaches, the following outcomes, outputs and activities have been designed as follows:

Outcome 1. Strengthen the regulatory framework for medical waste management and upgrade or establish performance levels for dedicated medical waste disposal facilities

Output 1.1 Strengthen the regulatory framework for medical waste management

Activity 1.1.1 Investigate, analyze and evaluate the laws and regulations on medical wastes and their implementation

Activity 1.1.2 Adapt the related regulations to the BAT/BEP requirements

Activity 1.1.3 Hold workshop to discuss the revised drafts

Activity 1.1.4 Circulate the drafts among governmental agencies, enterprises, academia, international community, and the public for comments

Activity 1.1.5 Promulgate the adapted regulations, and introduce and implement enforcement mechanisms

Output 1.2 Upgrade or establish performance levels for dedicated medical waste disposal facilities

Activity 1.2.1 Investigate and analyze feasibility to upgrade or establish new pollution performance levels

Activity 1.2.2 Draft the upgraded pollution control levels for the incineration of medical waste to the BAT achievable performance level

Activity 1.2.3 Draft the pollution performance levels for non-incineration treatment of medical waste

Activity 1.2.4 Hold a workshop with representatives from international organizations, governments, academia, enterprises, and the public to review the proposed performance levels

Activity 1.2.5 Select 3 provinces for first pilot implementation of the upgraded performance levels

Activity 1.2.6 Revise the performance levels by incorporating the experience from the pilot implementation

Activity 1.2.7 Circulate the revised performance levels for comments and forward to SEPA for review

Activity 1.2.8 Promulgate the revised performance levels nationwide as technical standard

Outcome 2 Strengthen the institutional capacity for integrated medical waste management at national and local levels in support of the Nationwide Investment Plan

Output 2.1 Establish a long-term national coordination mechanism for integrated medical wastes management

Activity 2.1.1 Establish a national medical waste management steering group led by SEPA and MOH and composed of other relevant ministries for coordination of integrated medical waste management

Activity 2.1.2 Regularly hold coordination meetings to provide guidance and coordination on issuance of laws, regulations, standards and policies and other important issues

Activity 2.1.3 Provide guidance to the establishment and operation of local steering groups on medical waste management

Output 2.2 Strengthen supervision and inspection on medical care institutions in medical waste management

Activity 2.2.1 Based on Output 3.1, develop Specifications for Health Agencies to Supervise Medical Institutions in Adoption of BEP on Medical Waste Management

Activity 2.2.2 Organize health departments to have trainings on the Specifications based on the staff training system established by Output 7.4

Activity 2.2.3 Establish and implement a medical waste data reporting system between medical care institutions and authorities

Activity 2.2.4 Establish a mechanism for the local environment and health departments to regularly inspect the implementation of the BEP for medical waste management

Output 2.3 Strengthen the monitoring and supervision capacity on medical waste treatment and disposal

Activity 2.3.1 Develop monitoring and supervision standards and norms

Activity 2.3.2 Train the municipal monitoring and supervision staff on the application of the methods

Activity 2.3.3 Develop and implement monitoring data publishing and reporting system

Activity 2.3.4 Undertake formal quarterly inspections in pilot medical wastes disposal facilities during the project implementation period

Output 2.4 Strengthen the environmental impact assessment on disposal facilities

Activity 2.4.1 Develop Guideline for Environmental Impact Assessment on Medical Disposal Facilities to include related existing or new engineering design standards and other related standards

Activity 2.4.2 Hold a training workshop on the implementation of the guideline to a qualified number of certified environmental impact assessors

Activity 2.4.3 Issue and implement the guideline nationwide on disposal facilities

Output 2.5 Strengthen the capacity to audit the operation of disposal facilities

Activity 2.5.1 Design and disseminate a methodology to audit disposal facilities

Activity 2.5.2 Develop accreditation and management measures for the establishment of national audit services

Activity 2.5.3 Support and encourage the existing institutions for the audit of the operation of disposal facilities

Outcome 3 Demonstrate BEP based management of medical waste including measurement and monitoring

Output 3.1 Demonstrate BEP in medical care institutions for the management of medical waste

Activity 3.1.1 Develop Specifications on Medical Waste Management in Medical Institutions

Activity 3.1.2 Develop Booklet for BEP Application in Medical Institutions for pilot application based on the previously achieved experience

Activity 3.1.3 Select 20 representative medical care institutions for the demonstration program

Activity 3.1.4 Develop the demonstration program, covering procurement, reduction, reuse, waste segregation, intermediate storage, transportation and traceability

Activity 3.1.5 Establish waste management systems and carry out staff trainings on BEP application at the demonstration institutions

Activity 3.1.6 Monitor, record and evaluate the implementation process and result

Activity 3.1.7 Validate the draft booklet by incorporating lessons and experience from the evaluations, issue and disseminate the validated booklet

Outcome 4 Demonstrate BAT for medical waste disposal using thermal combustion including air pollution monitoring

Output 4.1 Demonstrate the application of BAT for incineration process of medical waste

Activity 4.1.1 Develop a draft Booklet of BAT Application for Incineration Process of Medical waste

Activity 4.1.2 Develop a draft Specification for Construction and Operation of Medical waste Disposal Facility Using Incineration Process

Activity 4.1.3 Select one representative existing facility for demonstration

Activity 4.1.4 Carry out the feasibility study and EIA of the demonstrative facility and develop the demonstration implementation plan

Activity 4.1.5 Retrofit and optimize the operation of the modified facility, including on-line PCDD/PCDF sampling system, and train the relevant managerial and operation staff

Activity 4.1.6 Validate the modified facility, and monitor, record and evaluate the implementation process and results

Activity 4.1.7 Validate the Booklet and the Specification by incorporating lessons and experience from the evaluation, issue and disseminate the validated Booklet and Specification

Output 4.2 Demonstrate the application of BAT in pyrolysis process of medical wastes

Activity 4.2.1 Develop Booklet of BAT Application in Pyrolysis Process of Medical wastes

Activity 4.2.2 Develop a draft Specification for Construction and Operation of Medical waste Disposal Facility Using Pyrolysis Process

Activity 4.2.3 Select 2 representative existing facilities for demonstration

Activity 4.2.4 Carry out the feasibility study and EIA of the demonstration facility and develop the demonstration implementation plan

Activity 4.2.5 Retrofit and optimize the operation of the modified facility, including on-line PCDD/PCDF sampling system, and train the relevant managerial and operation staff

Activity 4.2.6 Validate the modified facility, and monitor, record and evaluate the implementation process and results

Activity 4.2.7 Validate the Booklet and the Specification by incorporating lessons and experience from the evaluation, issue and disseminate the validated Booklet and Specification

Outcome 5 Demonstrate BAT/BEP for medical waste thermal non-combustion, chemical treatment or other appropriate non-combustion treatment

Output 5.1 Demonstrate the application of BAT in autoclaving process of medical waste

Activity 5.1.1 Develop Booklet of BAT Application in Autoclaving Process of Medical waste

Activity 5.1.2 Develop a draft Specification for Construction and Operation of Medical waste Disposal Facility Using Autoclaving Process

Activity 5.1.3 Select one representative existing facility for demonstration

Activity 5.1.4 Carry out the feasibility study and EIA of the demonstration facility and develop the demonstration implementation plan

Activity 5.1.5 Procure, retrofit, and operate the modified facility and train the relevant managerial and operation staff

Activity 5.1.6 Validate the modified facility, and monitor, record and evaluate the implementation process and results

Activity 5.1.7 Validate the Booklet and the Specification by incorporating lessons and experience from the evaluation, issue and disseminate the validated Booklet and Specification

Output 5.2 Demonstrate the application of BAT in other non-incineration processes of medical waste

Activity 5.2.1 Develop Booklet of BAT Application in Other Non-incineration Processes of Medical wastes

Activity 5.2.2 Develop a draft Specification for Construction and Operation of Medical waste Disposal Facility Using Other Non-incineration Process

Activity 5.2.3 Select 2 representative existing facilities for demonstration of microwave irradiation, chemical disinfection, or combination

Activity 5.2.4 Carry out the feasibility study and EIA of the demonstration facilities and develop the demonstration implementation plan

Activity 5.2.5 Procure, retrofit, and operate the modified facility and train the relevant managerial and operation staff

Activity 5.2.6 Validate the modified facility, and monitor, record and evaluate the implementation process and results

Activity 5.2.7 Validate the Booklet and the Specification by incorporating lessons and experience from the evaluation, issue and disseminate the validated Booklet and Specification

Output 5.3 Demonstrate the application of BAT/BEP for treatment and disposal of medical wastes in remote rural areas

Activity 5.3.1 Develop Booklet of BAT/BEP Application for Treatment and Disposal of Medical Wastes in remote rural areas

Activity 5.3.2 Select representative remote rural areas for demonstration of the recommended BAT/BEP of the Booklet

Activity 5.3.3 Develop the demonstration implementation plan

Activity 5.3.4 Procure, install and operate autoclave or microwave facilities and train the relevant managerial and operation staff in order to avoid open burning of medical wastes as a common practice.

Activity 5.3.5 Monitor, record and evaluate the implementation process and results

Activity 5.3.6 Validate the Booklet by incorporating lessons and experience from the evaluation, issue and disseminate the validated Booklet

Outcome 6 **Demonstrate spatially integrated and coordinated medical waste management and disposal systems in geographically defined clusters that include medical institutions and dedicated treatment and disposal facilities**

Output 6.1 *Demonstrate the application of integrated medical waste management among institutions at the municipal level*

Activity 6.1.1 Select 3 demonstrations municipalities

Activity 6.1.2 Participation of project stakeholders to international symposia and undertake field visits to learn international experience in integrated medical waste management among institutions

Activity 6.1.3 Establish inter-departmental mechanisms for policy consultation and coordination for integrated medical waste management among institutions at municipal level

Activity 6.1.4 Develop municipal-level integrated medical waste management information system

Activity 6.1.5 Monitor, record and evaluate the implementation process and results

Output 6.2 *Demonstrate coordinated medical waste treatment among the dedicated medical waste facilities at the provincial level*

Activity 6.2.1 Select 3 demonstration provinces for coordinated medical waste management and treatment

Activity 6.2.2 Assist the selected provinces establish provincial medical waste management steering groups

Activity 6.2.3 Hold a coordinating workshop among the provincial and municipal departments and the dedicated medical waste treatment facilities

Activity 6.2.4 Develop and carry out a logistics plan for the coordinated activities

Activity 6.2.5 Promulgate and implement supporting policies by the local government

Activity 6.2.6 Monitor, record and evaluate the implementation process and results

Outcome 7 **Develop and formulate a national strategy and action plan of BAT/BEP for medical waste management and disposal based on the experience gained through the demonstration activities of the project**

Output 7.1 *Formulate techno-economic policies that promote the adoption of BAT/BEP*

Activity 7.1.1 Investigate and analyze the needs of techno-economic policies according to the requirements of BAT/BEP and the Convention

Activity 7.1.2 Draft the needed techno-economic policies

Activity 7.1.3 Hold a policy dialogue workshop for representatives from governments, international and domestic experts, enterprises, and the public

Activity 7.1.4 Circulate the policy texts for comments

Activity 7.1.5 Incorporate the comments into the final policy texts

Activity 7.1.6 Submit the policies to SEPA and other related ministries for promulgation

Output 7.2 *Demonstrate and promote different commercial models for the construction and operation of medical waste treatment and disposal facilities*

Activity 7.2.1 Develop investment models to facilitate medical waste treatment and disposal

Activity 7. 2.2 Conduct trainings for government officials and enterprises managers from at least 60 municipalities in the realization and management of medical waste management

projects

Activity 7.2.3 Assist at least 20 municipalities in establishing medical waste management steering groups

Activity 7.2.4 Provide technical assistance to the municipalities with medical waste management steering group in adopting BOT, BOO, TOT models, etc.

Activity 7.2.5 Provide incentives to facility owners to purchase certified equipment

Activity 7.2.6 Establish technical consulting institutions to provide technical services in options for private investment

Output 7.3 Strengthen national capacity to develop new medical waste treatment technologies appropriate to China's socio-economic context

Activity 7.3.1 Identify, evaluate and establish the catalogue of processes, techniques and equipment in great demand while not yet made locally available and affordable in China

Activity 7.3.2 Hold 3 workshops for representatives from national and local governments, international technology vendors, domestic research institutes, equipment manufacturers, and medical waste treatment operators to discuss technology supplies and demands for incineration, autoclave, and other non-incineration technologies in order to facilitate the establishment of domestic manufacturing capacities

Activity 7.3.3 Establish incentives to encourage joint development of market needed technologies and equipment by international vendors and domestic research entities

Activity 7.3.4 Establish incentives for successful application of advanced feasible technologies and equipment

Output 7.4 Develop and implement a medical waste treatment equipment certification and labeling program

Activity 7.4.1 Develop technical requirements for Certification and Labeling of Medical Waste Treatment Equipment

Activity 7.4.2 Develop procedures on Certification and Labeling of Medical Waste Treatment Equipment

Activity 7.4.3 Strengthen the capacity of certification institutions

Activity 7.4.4 Strengthen the capacity of the testing institutions and laboratories

Activity 7.4.5 Hold series of workshops targeting separate technologies, implementation of the certification and labeling program, and participation of equipment producers and investors in the program

Activity 7.4.6 Carry out pilot certification and labeling on qualified products produced by those manufacturing enterprises of better-off conditions

Activity 7.4.7 Launch extensive publicity in the medical waste treatment sector

Output 7.5 Establish training and accreditation systems for the lifecycle management of medical waste that support BAT/BEP

Activity 7.5.1 Integrate all the experience and results from demonstrations and other external successful experience to compile textbooks for managerial and technical trainings

Activity 7.5.2 Develop various curricula to meet different training needs such as entry training, on-the-job training, refresh training, etc.

Activity 7.5.3 Train the trainers in environmental and health sectors

Activity 7.5.4 Formulate Regulations and Resources Requirements for Medical Waste Management Training Institutions

Activity 7.5.5 Based on the existing administrative structure and training system of the health administration, establish a 4-tier personnel training system covering national, provincial, municipal, and county medical institutions, including the establishment of 7 training bases for the training of high-level managerial and technical staff in health agencies and medical institutions

Activity 7.5.6 Based on the existing environmental technical training and research system, establish 3 training bases for training of dedicated medical waste treatment staff

Output 7.6 Extensive stakeholder awareness raising, including a series of national and international workshops

Activity 7.6.1 Prepare technical materials for targeted stakeholder awareness for administrators, managers and other influential players in national investment programs where the outputs of the project can potentially be replicated.

Activity 7.6.2 Launch awareness raising and education campaign to the identified stakeholders using direct communication including publications and lectures.

Activity 7.6.3 Promote academic and professional articles for envirometnally sustainable medical waste management

Activity 7.6.4 Organize a workshop at the end of the project bringing together all stakeholders and consultants/companies involved to evaluate the Outcomes of the project

Activity 7.6.5 Hold a national workshop with participation from all provinces and stakeholders

Activity 7.6.6 Hold an international workshop to share the national experience with representatives from other countries and also learn from their experiences

Outcome 8 Project management, monitoring and evaluation

Output 8.1 Establish the project management structure

Activity 8.1.1 Establish the Steering group by relying on resources from related ministries or commissions at the national level and from local governmental agencies

Activity 8.1.2 Establish the National Project Management Team under CIO

Activity 8.1.3 Recruit a CTA, a NTA, policy experts, technical experts in medical waste management, and evaluation and programming experts to form a project expert team

Activity 8.1.4 Establish 3 local PMOs in selected provinces for intensive demonstrations

Activity 8.1.5 Carry out a series of management training classes to the national and local project management staff

Output 8.2 Design and implement an M&E mechanism according to GEF M&E procedures

Activity 8.2.1 Hold the Inception Workshop

Activity 8.2.2 Prepare the Inception Report

Activity 8.2.3 Measure impact indicators on an annual basis

Activity 8.2.4 Prepare Annual Project Reports and Project Implementation Reviews

Activity 8.2.5 Hold annual tripartite review meetings

Activity 8.2.6	Hold biannual Steering group meetings
Activity 8.2.7	Carry out mid-term external evaluation
Activity 8.2.8	Carry out final external evaluation
Activity 8.2.9	Complete the Terminal Report
Activity 8.2.10	Carry out annual project financial audits
Activity 8.2.11	Carry out biannual visits to selected field sites
Activity 8.2.12	Establish a project management information system (MIS), including a project website to disseminate information to various stakeholders

4. RISKS, SUSTAINABILITY AND REPLICABILITY

4.1 Possible Risks

202. The risks are identified with reference to project objectives as follows:

Objectives	Risks	Level	Mitigation measures
Review, revision and recommendation of appropriate changes of the regulatory and policy enabling environment	Laws and regulations are not enforced and not communicated to appropriate local authorities or partially applied	Low	Ensure laws are practical and enforceable and support with institutional capacity building and training
Institutional strengthening through the use of targeted technical transfer activities to apply and disseminate BEP in the lifecycle management of medical waste	Level of capacity at institutional level is underestimated; lack of institutional commitment and difficulty in identifying the institutional unit to be targeted	Low	Focus on stakeholder awareness raising as a priority
Application of BAT in 6 targeted municipalities within the project implementation period	Lack of cooperation from municipalities coupled with lack of necessary physical, technical and human resources at demonstration site; shortcomings in the collection and transportation systems leading to shortage of waste and intermittent operational time	Low	Selection of demonstration on the basis of nationwide competitive bidding backed up with comprehensive capacity building
Design and implementation of economic and financial systems that can sustainably support the medical waste management sector	Inability to collect fees coupled with weak financial managed systems and lack of incentive at hospital level to operate system because the financial benefit is seen to be with the treatment facility only	Moderate	Design out identified weaknesses with training to improve implementation
Support for development of an industrial base that promotes a precautionary and preventive approach to domestic goods, services and the appropriate adaptation of technologies	Conflicting stakeholder issues compounded with conflicting industrial sector interests and possible low interest level because of lack of clarity on commercial and investment parameters	Low	SEPA generates incentives that promotes interest in alternative technologies and BAT efficiencies
Identification, demonstration and promotion of appropriate medical waste management systems and technologies applicable to remote rural areas	Lack of infrastructure and geographical remoteness coupled with human resources pressure impede the demonstration projects in remote rural areas	Moderate	Develop specific plans and methodologies that take into account these challenges
Coordination of medical waste management with an effective transfer system in targeted province	Institutional conflict of interest impedes cooperation at provincial level	Moderate	Communication of the mutual benefits of cooperation including economic and financial benefits
Formulation of a nationwide replication program to disseminate BAT/BEP as part of a national strategy and action plan	Project has time relevance to larger context. Slippage in the timing could threaten the full implementation of some of the objectives within the project timeframe. Time delays will impact the projects relevance and influence on the Nationwide Investment Plan	Low	Avoid delays by close of project management schedule and manage the impact of any delay by close communication with stakeholders

4.2 Sustainability and Replicability

203. The sustainability of the project outputs will be ensured by the following:

- Strengthening and adaptation of laws, regulations, and policies related to medical waste management will ensure the sustainability of the regulatory environment. By assuring the practicality of laws and regulations, enforcement is improved supported by capacity building.
- Compliance with ongoing monitoring and reporting requirements under the Stockholm Convention will be improved by increasing the capacity to collect and process data and to formulate reports to the standards required by the Convention.
- By improving institutional capacity at national and local levels, awareness and knowledge are increased and informed concerted stakeholder action becomes a second nature.
- The momentum generated by the mobilization of stakeholders at central and local levels becomes self-sustaining given the critical mass of the project activities both at the levels of nationwide dissemination and the intensive location specific demonstration activities.
- Commitment to a significant National Investment Plan in medical waste management provides a context and rationality for the project outputs thereby assuring their relevance and sustainability.
- The relevance of the project in the context of infection control and the strong national and international focus on global public health issues resulting from the SARS, HIV-AIDS, avian flu, and other high risk global infectious diseases guarantees the sustainability of the project outputs.

204. The financial sustainability of the project will be ensured by:

- A well designed and implementation fee-based medical waste management system will generate revenues to assure the operation and maintenance of treatment facilities while the application of operational efficiencies through BEP will contribute to the economic running of medical institutions;
- The emergence of industrial and service sectors dedicated to the technical and technological support of BAT/BEP in medical waste management will generate economic activity and employment;
- The development and promotion of different commercial models (e.g. BOT, BOO, TOT, etc.) for construction and operation of medical waste treatment and disposal facilities will assure initial and continuing capital investment in the sector.

5. STAKEHOLDER PARTICIPATION AND PROJECT IMPLEMENTATION

5.1 Stakeholder Participation

205. The Convention Implementation Office (CIO) organized the kick-off meeting for the preparatory phase of the project, which was attended by the Ministry of Health, SEPA and all other health-related ministries and commissions. At the kick-off meeting, a cross-department steering committee was established and guidance was provided for the preparation of the project. The CIO subsequently commissioned a multidisciplinary Expert Group composed of international and domestic hospital waste management experts, medical waste treatment and disposal experts, regulatory and policy experts and environmental economist. The Expert Group was tasked with the preparation of the project brief and supporting documentation. The steering committee provided substantive valuable guidance to the Expert Group in the whole project preparation process. Development of the project proposal also benefited significantly from the active participation of professional staff responsible for the development and implementation of the Nationwide Investment Plan.

206. During the preparation of the project proposal, the Expert Group carried out extensive field surveys and consultations in a number of representative medical institutions and medical waste disposal units in Eastern, Central and Western China. The Expert Group also completed questionnaires and a census survey, which provided a basis for identifying and analyzing barriers for a successful project implementation and designing project activities.

207. SEPA and UNIDO also organized and sponsored a study tour to visit hospitals and medical waste management facilities in India, Ireland, and Italy. UNIDO, The U.S. Environmental Protection Agency and the Italian Ministry of Environment and Territory also commissioned a review of international best practices in medical waste management and their applicability to China. Each of these activities provided a valuable contribution to project design. (for details, see Annex 1 on International Experience in medical waste management.)

208. During the implementation of the project, the Project Team will actively coordinate, liaise with, and mobilize stakeholders, as summarized in Table 2 below for key stakeholders under each project output.

Table 2: Involvement and participation of stakeholders

Output	Key stakeholders	Means of involvement and participation
Output 1.1 Strengthen the regulatory framework for medical waste management	SEPA, MOH, MW disposal facilities, MIs, academic community, the public, international community	Consultation and review meetings, commenting, public hearings, law promulgation and implementation
Output 1.2 Upgrade or establish performance levels for dedicated medical waste disposal facilities	SEPA, MOH, MW disposal facilities, MIs, academic community, technology vendors, the public, international community	Consultation and review meetings, commenting, public hearings, standards issuance and implementation
Output 2.1 Establish a long-term national coordination mechanism for integrated medical waste management	NDRC, SEPA, MOH, MOC, and Department of Price Management	Review meetings, guiding and coordination

Output	Key stakeholders	Means of involvement and participation
Output 2.2 Strengthen supervision and inspection of medical care institutions in medical waste management	MOH, local departments of health, MIs	Supervision, inspection, and enforcement and compliance
Output 2.3 Strengthen the monitoring and supervision capacity of medical waste treatment and disposal	SEPA, local environmental protection bureaus, MW disposal facilities	Monitoring, inspection, and enforcement and compliance
Output 2.4 Strengthen the environmental impact assessment of disposal facilities	SEPA, local environmental protection bureaus, EIA institutions, MW disposal facilities, the public	Administrative guiding, review, approval, assessment, and public hearings
Output 2.5 Strengthen capacity to audit the operation of disposal facilities	SEPA, local environmental protection bureaus, facility audit institutions, MW disposal facilities	Administrative guiding, review, audit
Output 3.1 Demonstrate BEP in medical care institutions for the management of medical waste	International organizations, academic community, MIs, local departments of health	Experience imparting, training, and enforcement and compliance
Output 4.1 Demonstrate BAT for incineration	International organizations, academic community, technology vendors, MW disposal facilities, local environmental protection bureaus	Experience imparting, training, equipment retrofit, and enforcement and compliance
Output 4.2 Demonstrate BAT in pyrolysis process	International organizations, academic community, technology vendors, MW disposal facilities, local environmental protection bureaus	Experience imparting, training, equipment retrofit, and enforcement and compliance
Output 5.1 Demonstrate BAT in MW autoclaving process	International organizations, academic community, technology vendors, MW disposal facilities, local environmental protection bureaus	Experience imparting, training, equipment retrofit, and enforcement and compliance
Output 5.2 Demonstrate BAT in other non-incineration processes	International organizations, academic community, technology vendors, MW disposal facilities, local environmental protection bureaus	Experience imparting, training, equipment retrofit, and enforcement and compliance

Output	Key stakeholders	Means of involvement and participation
Output 5.3 Demonstrate BAT/BEP for treatment and disposal of medical wastes in remote rural areas	International organizations, academic community, technology vendors, MW disposal facilities, local environmental protection bureaus	Experience imparting, training, equipment retrofit, and enforcement and compliance
Output 6.1 Demonstrate the application of integrated medical waste management among institutions at the municipal level	Municipal departments of health, environment, transportation, construction, price, MIs and MW disposal facilities	Coordination, consultation, communication, cooperation, planning, implementation
Output 6.2 Demonstrate coordinated medical waste treatment among the dedicated medical waste facilities at the provincial level	Provincial departments of environment, and transportation, and MW disposal facilities	Coordination, consultation, communication, cooperation, planning, implementation
Output 7.1 Formulate techno-economic policies that promote adoption of BAT/BEP	SEPA, MOF, State Administration of Taxation, technology vendors, MW disposal facilities, academic community	Policy dialogues, consultation, development, issuance, and implementation
Output 7.2 Demonstrate and promote different commercial models for the construction and operation of medical waste treatment and disposal facilities	Local governments, entrepreneur, technology vendors, MIs	Project financing, BOT-like operations
Output 7.3 Strengthen national capacity to develop new medical waste treatment technologies appropriate to China's socio-economic context	SEPA, research funding authorities, R&D institutes and enterprises, international technology vendors	Scientific research program development and implementation, joint venture establishment
Output 7.4 Develop and implement a medical waste treatment equipment certification and labeling program	Certification and Accreditation Administration, SEPA, certification bodies, testing bodies, technology vendors	Certification and labeling procedures establishment and implementation
Output 7.5 Establish training and accreditation systems for lifecycle management of medical waste that support BAT/BEP	SEPA, MOH, academic community, training institutions, MIs, and MW disposal facilities	Medical staff and disposal operator training, training management
Output 7.6 Extensive stakeholder awareness raising, including a series of national and international workshops	Industrial associations, NGOs, media, the public	Publicity material development and dissemination

Output	Key stakeholders	Means of involvement and participation
Output 8.1 Establish the project management structure	MOH, SEPA, CIO, academic community, local governments	Project administration and management, receiving trainings
Output 8.2 Design and implement an M&E mechanism according to GEF M&E procedures	MOH, SEPA, CIO, academic community, local governments	Monitoring and Evaluation

5.2 Project Implementation Arrangements

209. Lifecycle management of medical waste involves vertically and horizontally a wide spectrum of stakeholders in the general administrative framework of China, while the primary responsibilities shall be taken by the stakeholders in health and environment sector. Annex 3 describes the mandates of the relevant stakeholders provides an administrative context under which their mandates will be translated into specific responsibilities in implementing this project by means of participating in the demonstrations, trainings, replication programs, establishing, enforcing or complying with regulations, etc. The project management structure is given in Figure 4 below.

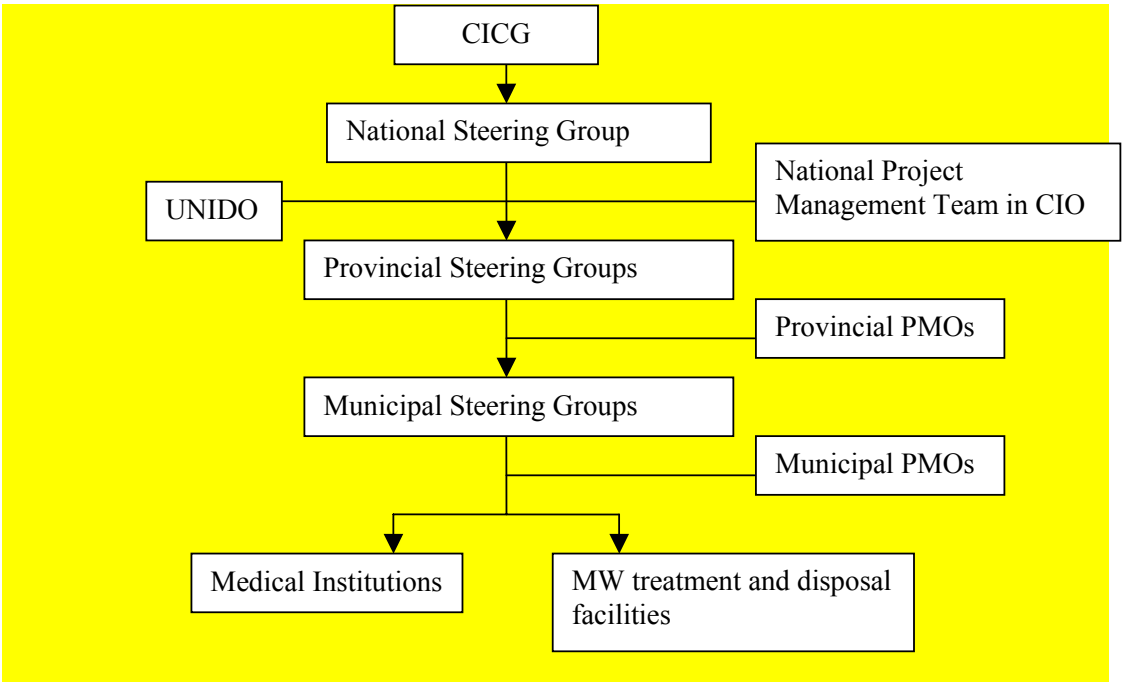

Fig. 4 Project Organogram

210. **Convention Implementation Coordination Group (CICG)**. China established the National NIP Development Leading Group in September 2003. This Group became the National Leading Group for Implementation of the POP Convention when China ratified the Convention on August 13, 2004, which was formally approved by State Council in April 2005 and renamed the National Technical Coordination Group (TCG) for Implementation of the Stockholm Convention, or Convention Implementation Coordination Group (CICG). The CICG will provide (i) review of significant policies related to POPs management and control, (ii) guidance and coordination for POPs management activities and Convention implementation. The CICG consists of the following 11 agencies:

1. State Environmental Protection Administration (SEPA)
2. National Development and Reform Commission (NDRC)
3. Ministry of Foreign Affairs (MOFA)
4. Ministry of Finance (MOF), which is the GEF Focal Point in China.
5. Ministry of Commerce (MOCom)
6. Ministry of Science and Technology (MOST)
7. Ministry of Agriculture (MOA)
8. Ministry of Public Health (MOH)
9. Ministry of Construction (MOC)
10. General Administration of Customs (GAC)
11. State Electricity Regulatory Commission (SERC)

211. **UNIDO:** A project focal point will be established within UNIDO to assist with project execution. This focal point will consist of dedicated core staff, supplemented by support from professional and support staff colleagues on a part-time as needed basis, including in particular senior staff engaged in the management and coordination of UNIDO's POPs program. UNIDO will make these services available as part of its in-kind contribution to the project.

212. **National, Provincial, and Municipal Steering Groups**. The project will establish a national steering group by drawing upon resources from related ministries or commissions in charge of development and reform, environment, health, construction, and pricing to provide the project team with political guidance and inter-ministerial coordination support. To facilitate the extensive demonstration and replication activities at provincial and municipal levels, the National Steering Group will encourage and assist provincial and municipal governments in the establishment and operation of their own corresponding steering groups.

213. **Convention Implementation Office (CIO)**. The CIO is part of SEPA and is responsible for coordinating day-to-day management of Stockholm Convention implementation in China. The CIO's responsibilities include: (i) provision of technical support for international negotiations and policy studies on the Stockholm Convention, (ii) provision of support for development and implementation of POPs-related policy and regulations, as well as coordination of key governmental stakeholders, (iii) mobilization of co-financing from bilateral, international, and national sources, (iv) collecting data and information, compiling reports, organizing training activities, and publishing information. The CIO will provide guidance to ensure the project's successful implementation, including regular monitoring and enforcement inspections. As the CIO is not an independent legal entity, Foreign Economic Cooperation Office (FECO) will represent SEPA and the CIO in the management and completion of contracts for project implementation.

214. **National Project Management Team for Environmentally Sustainable Management of Medical Waste in China**. The National Project Management Team will be composed of staff from SEPA, MOH, NDRC, MOC, and other relevant agencies. SEPA will designate a coordinator/team leader. The Project Management Team will be responsible for day-to-day management and execution of the project, and will oversee local project management offices. The Project Team's responsibilities will include (i) assignment and supervision of project activities; (ii) recruitment of international and national consultants; (iii) providing guidance to local PMOs; (iv) coordination with stakeholders, donors, the IA, relevant national agencies and the private sector; (v) preparation of terms of reference (TORs) for project activities, (vi) review of project progress reports submitted by the local PMOs, (vii) supervising project procurement and financial resources in accordance with UNIDO procedures, (viii) organizing and convening project coordination stakeholder meetings, and (ix) review of project outputs. See more detailed description of the work to be performed by the national project management team in Annex 4 - Terms of References.

215. **Project Expert Team**. The project will recruit an international CT A, a NTA, policy experts, waste management industry experts, health sector experts, chemists, monitoring & evaluation experts, and other technical experts. These experts will form a Project Expert Team to assist the

CIO and Project Management Team through the following activities (See more detailed description of the work to be performed by the national expert team in Annex 4 - Terms of References):

i) Introduction of successful experiences gained from foreign countries;
ii) Management and coordination of all project activities;
iii) Provision of technical support for policy framework, institutional strengthening, demonstration activities, technology selection, market promotion, awareness raising and education, results and experience dissemination, project monitoring and evaluation, replication program development, and project management;
iv) Periodic project implementation progress appraisal;
v) Support for development of training materials; and
vi) Liaison for international symposia and field research.

216. **Local Project Management Offices (PMO)**. The project will involve a large number of medical institutions (MIs) and dedicated medical waste (MW) treatment facilities nationwide at national, provincial, municipal, county and sub-county levels. Extensive awareness promotion and training activities will be conducted at community and local governmental levels. Oversight for the implementation of relevant regulations will rely on local administrative agencies. The breadth of these activities poses a significant management and coordination challenge to the national Project Management Team. In order to effectively implement the project and fully involve local stakeholders:

- Three **provincial PMOs** will be established in the 6 provinces where demonstration of coordinated planning that will spatially cluster incineration and non-incineration facilities will be carried out to achieve optimal socio-economic and environmental benefits by implementing an effective medical waste transfer system in a geographically defined regional context. The provincial PMOs will be composed of staff from relevant provincial governmental agencies. Their responsibilities include (i) management of the provincial level activities; (ii) oversight of municipal implementation; (iii) dissemination of the experience emanating from demonstration municipalities; and (iv) collecting information and preparing progress reports. Their specific responsibilities will be defined by the national project team supported by the national expert team after the inception workshop.

- Six **municipal PMOs** will be established in the 6 municipalities where there will be extensive demonstrations of BAT/BEP for integrated medical management that will cluster the medical institutions and medical waste treatment or disposal facilities. The municipal PMOs will be composed of staff from relevant municipal governmental agencies. Their responsibilities include (i) coordination/organization of local training programs and seminars; (ii) overseeing facility construction and operation; (iii) oversight of regulatory implementation; (iv) disseminating experience from demonstration MIs to the rest in the municipalities; and (v) collecting information and preparing progress reports. Their specific responsibilities will be defined by the national project team supported by the national expert team after the inception workshop.

217. **Medical institutions** and **medical waste treatment and disposal facilities** will participate in the demonstrations, trainings, and replication programs in this project under the policy and regulatory framework to be strengthened by this project.

6. INCREMENTAL COSTS AND PROJECT FINANCING

218. The GEF, as the financial mechanism for the Stockholm Convention, will provide a proposed US$12 million incremental cost funding for the project, including US$ 350,000 expended for the project preparation. The Government of the Unites States is committed to provide US$120,000 in cash/in-kind contribution for certain spectrum of activities covering hospital waste reduction, incineration stack emission monitoring and relevant training. UNIDO will provide an in-kind contribution of US$100,000 for project management, monitoring and evaluation..

219. The Central Government of China has committed to provide 30 million RMB or equivalent of US$ 3.8 million as cash co-financing from the Ministry of Finance to be used mainly for legal and institutional strengthening and capacity building. In addition, SEPA is committed to leverage US$ 15 million from the approved Nationwide Investment Plan as in-kind co-financing to be used mainly for baseline equipment purchase and installation at dedicated medical waste disposal facilities as well as relevant capacity building activities.

220. Under the preparatory phase of the project, the CIO has undertaken extensive communications with dedicated MW facilities and equipment providers and has received a positive response from them regarding the provision of co-financing to the project. The CIO published a call for expression of interest through its official website (www.chinapops.org), and notified all treatment facilities and equipment manufacturers in China by email, telephone, and meetings. So far, 14 enterprises have submitted their commitment to provide co-financing. During project implementation, 6 enterprises will be selected to provide a total co-financing of at least 75 million RMB, equivalent to US$ 9,557,140 for demonstration and replication of BAT/BEP in this project. Total co-financing for the project is projected at US $33, 077,140.

Baseline

221. Disposal of medical waste in dedicated facilities started as an emergency measure after the SARS outbreak in 2003 and prior to China's accession to the Stockholm Convention. The Nationwide Investment Plan was designed on the basis of environmental and health standards existing at that time in China and incineration technology was designated as the primary disposal technology. The Program focused on the elimination of public health threats posed by medical waste and gave less consideration to the application of BAT/BEP in implementing integrated management systems for medical waste or for controlling PCDD/PCDF and other pollutants releases.

222. In the absence of this project, the medical waste disposal sector in China is characterized as follows:

- A regulatory framework focused on infection control.
- Under-developed institutional capacities, in terms of both hardware (infrastructure) and software (skills and expertise) for supervision and inspection of medical institutions and medical waste disposal facilities in terms of pollution control and monitoring, environmental impact assessment, and operation risk evaluation.
    - Incinerators continue to play the predominant role in the disposal of medical waste and generate unintentional POPs releases that significantly exceed BAT performance levels.
    - Non-combustion alternatives, which can avoid formation of PCDD/PCDF have not been adopted.

- Integration and coordination of medical waste management, treatment and disposal systems have not been explored to achieve optimal social, economic and environmental benefits.
- National debts and local government investments remain the principal financial source for construction of dedicated medical waste disposal facilities, but are unsustainable.
- Stakeholder awareness regarding secondary pollution from medical waste disposal is insufficient.
- The fee-based system supporting medical waste management, treatment and disposal systems has not been operated adequately and effectively.

Global Environmental Objective

223. Like other POPs, PCDD/PCDF is a group of toxic chemicals that resist degradation, bio-accumulate and have the potential for long-range transport. Exposure to these chemicals can harm human health and ecosystems at locations both near the site from which they escape into the environment, and at very far distances from that site, with severe adverse impact on wildlife, aquatic and marine life, domestic animals, and humans. Due to their unique properties, POPs do not respect national boundaries, and therefore pose a special challenge that makes it impossible for any one-nation acting alone to address the POPs problem.

224. Many well-established studies have confirmed that PCDD/PCDF pose a serious human cancer risk. In addition to cancer, exposure to these compounds can also cause severe reproductive and developmental disorders. As endocrine disruptors, PCDD/PCDFs are well known for their ability to damage the immune system and interfere with hormonal systems. PCDD/PCDF exposure have been linked to birth defects, inability to maintain pregnancy, decreased fertility, reduced sperm counts, endometriosis, diabetes, learning disabilities, immune system suppression, lung problems, skin disorders, lowered testosterone levels and much more.

225. The overall objective of the project is to reduce and ultimately eliminate the release into environment of PCDD/PCDF and other global pollutants (such as mercury) from medical waste incinerators, and to assist China in implementing its obligations under the Stockholm Convention.

Alternative

226. Through this project, medical institutions will adopt BEP for medical waste management. Waste reduction at source will help achieve resource conservation; reduce collection, transportation, treatment, and disposal costs; and decrease pollution control liability and cost. Waste segregation will reduce the waste stream's volume and toxicity. Proper procurement practices, such as switching to products and materials that do not contain PCDD/PCDF precursors, will substantially reduce PCDD/PCDF emissions. Increased hospital staff awareness of hazardous and infectious materials management will also reduce accidental injuries and cross-infection cases.

227. This project will achieve great reduction of air pollutant emission from medical waste incinerators through the application of BAT in the combustion process and through the improvement and optimization of necessary air pollution control devices, such as activated carbon tower, bag filters, dry or wet scrubbers, lime and activated carbon injection. No incineration equipment purchase is foreseen by the project.

228. BAT will also be applied to replace outdated incinerators with alternative non-combustion medical waste technologies, such as autoclaving and microwaving, which can avoid

unintentional PCDD/PCDF formation. In applying these alternatives, emphasis will be placed on sterilization efficacy and VOCs emission control to ensure safe disposal of medical wastes.

229. The project will significantly contribute to the POPs focal area as follows:

- Reduction in releases of by-products by means of BAT/BEP demonstration and adoption in incineration facilities within the project areas and time frame: 1.94 g TEQ per year amounting to US$ 150,000 per g TEQs. National replication will result in a reduction of 47.88 g TEQ/year with a corresponding incremental cost of US$ 7,182,000/year.
- Avoided releases of by-products by means of BAT/BEP demonstration and adoption of alternative treatment processes: 2.59 g TEQ per year amounting to US$ 66,274 per g TEQs.

230. Due to the very high price tag of monitoring PDCC/PDCF, the incremental costs of incinerators will be higher than those of non-combustion technology equipment in which the possibility of unintentional POPs production and the monitoring expenses are significantly less. It is true in spite of the fact that the project has targeted incineration facilities with good APCS, so that only process optimization and improvement (including environmental monitoring) need to be carried out by the project without significant capital equipment budget requirements and for non-combustion technologies supported by the project, the budget for the procurement of equipment is necessary, given that no pre-existing facility is involved.

Table 3: Summary Incremental Cost Matrix in USD

Project Components/Outcomes	**Baseline**	**Increment**	**Alternative**
Outcome 1. Strengthen the regulatory framework for medical waste management and upgrade or establish performance levels for dedicated medical waste disposal facilities	514,295	373,785	888,080
Outcome 2. Strengthen the institutional capacity for integrated medical waste management at national and local levels in support of the Nationwide Investment Plan	3,460,185	1,439,485	4,899,670
Outcome 3. Demonstrate systems management and the application of BEP	1,646,375	678,125	2,324,500
Outcome 4. Demonstrate BAT for medical waste disposal using thermal combustion including air pollution monitoring	10,759,600	2,472,600	13,232,200
Outcome 5. Demonstrate BAT/BEP for medical waste thermal non-combustion, chemical treatment or other appropriate non-combustion treatments	7,600,450	1,984,450	9,584,900
Outcome 6. Demonstrate spatially integrated and coordinated medical waste management and disposal systems in geographically defined clusters that include medical institutions and dedicated treatment and disposal facilities	1,287,200	1,137,200	2,424,400
Outcome 7. Develop and implement a strategy for the adoption of BAT/BEP for medical waste management and disposal	5,830,755	2,565,085	8,395,840
Outcome 8. Project management, monitoring and evaluation	1,758,280	1,197,220	2,955,500
Total Project Costs	**32,857,140**	**11,870,000**	**44,727,140**

7. MONITORING AND EVALUATION

7.1 Project implementation monitoring

Project Inception Phase

231. A Project Inception Workshop (IW) will be conducted with the full project team, relevant government counterparts, co-financing partners, UNIDO and representative from the UNIDO Country Office (CO), as appropriate.

232. The fundamental objective of this Inception Workshop will be to assist the project team in understanding and assimilating the goals and objectives of the project, as well as to finalize the preparation of the project's first annual work plan on the basis of the project's logframe matrix. This work will include reviewing the logframe (indicators, means of verification, assumptions), imparting additional detail as needed, and completing an Annual Work Plan (AWP) for the first year of project implementation, including measurable performance indicators.

233. Additionally, the IW will: (i) introduce project staff to the UNIDO team, which will support the project during its implementation; (ii) delineate the roles, support services, and complementary responsibilities of UNIDO staff vis à vis the project team; (iii) provide a detailed overview of UNIDO reporting and Monitoring & Evaluation (M&E) requirements, with particular emphasis on Annual Project Implementation Reviews (PIRs), the Annual Project Report (APR), Tripartite Review (TPR) meetings, as well as mid-term and final evaluations. Equally, the IW will provide an opportunity to inform the project team on UNIDO project related budgetary planning, budget reviews and mandatory budget rephrasing.

234. The IW will also provide an opportunity for all parties to understand their roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines and conflict resolution mechanisms. The Terms of Reference (TOR) for project staff and decision-making structures will be discussed, as needed, in order to clarify each party's responsibilities during the project's implementation phase.

Monitoring responsibilities and events

235. A detailed schedule of project review meetings will be developed by the project management team in consultation with the project implementation partners and stakeholder representatives and incorporated in the Project Inception Report. The schedule will include: (i) tentative time frames for Tripartite Reviews, Steering Committee Meetings (or relevant advisory and/or coordination mechanisms), and (ii) project related Monitoring and Evaluation activities.

236. Day to day monitoring of project implementation progress will be the responsibility of the National Project Coordinator based on the project's Annual Work Plan and its indicators. The Project Team will inform UNIDO of any delays or difficulties faced during implementation so that the appropriate support or corrective measures can be adopted in a timely and remedial fashion.

237. The Project Manager, the NTA and the CTA will fine-tune the progress and performance/impact indicators for the project in consultation with the full project team at the Inception Workshop. Specific targets for the first year implementation progress indicators together with their means of verification will be developed in this workshop. These will be used to assess whether implementation is proceeding at the intended pace and in the right direction and will form part of the Annual Work Plan. Targets and indicators for subsequent years will be reviewed annually

as part of the internal evaluation and planning processes undertaken by the project team. Local/regional PMOs will also take part in the IW.

238. Measurement of impact indicators related to global benefits will be done according to the schedules defined in the IW. These will be undertaken through subcontracts or retainers with relevant institutions or through specific studies that are to form part of the projects activities. Indicators of project goal, progress and performance will be continuously monitored and evaluated throughout the whole project life. Impact indicators to be measured include but not limited to:
    - Number of medical institutions adopting BEP;
    - Number of dedicated medical waste disposal facilities adopting BAT;
    - Number of dedicated medical waste treatment facilities adopting BAT/BEP;
    - Quantitative and qualitative change in medical waste disposed of;
    - Reduction of manufacturing and use of medical care products containing hazardous substances such as Hg and PVC;
    - Reduction of PCDD/PCDF emissions from medical waste incineration disposal;
    - Avoid releases of PCDD/PCDF emissions from medical waste treatment;
    - Level of stakeholder awareness and participation in environmentally sound medical waste management;
    - Levels of PCDD/PCDF in biological organisms in the vicinity of dedicated medical waste treatment and disposal facilities; and
    - Social and economic benefits from the adoption of BAT/BEP.

239. At least two inspections will be conducted during project implementation to determine the extent of the adoption of BAT/BEP and supervise enforcement of relevant regulations, rules and standards.

240. UNIDO through quarterly meetings with project counterparts or as frequent as deemed necessary will undertake periodic monitoring of the project implementation progress. This will allow parties to troubleshoot any problems pertaining to the project in a timely fashion to ensure the smooth implementation of project activities.

241. UNIDO and/or UNIDO Country Office will conduct periodic visits based on agreed schedule to be detailed in the project's Inception Report / Annual Work Plan to assess project progress. Other members of the Steering Committee (SC) may also accompany these visits. A Field Visit Report will be prepared by UNIDO and will be circulated to the project team and all SC members no less than one month after the visit.

242. Annual Monitoring will occur through Tripartite Review (TPR) meetings, which will take place at least once every year. The first such meeting will be held within twelve months of the start of the full project implementation. The PMOs will prepare an Annual Project Report (APR) and submit it to UNIDO at least two weeks prior to the TPR for review and comments.

243. The TPR has the authority to suspend funds disbursement if project performance benchmarks are not met.

Terminal Tripartite Project Review

244. The terminal tripartite project review (TTPR) meeting will be held in the last month of project operation. The project proponent is responsible in the preparation of the Terminal Report and its submission to UNIDO. It will be prepared in draft at least two months in advance of the TTPR

in order to allow more time for its review. This will serve as the basis for discussions in the TTPR meeting. The TTR considers the implementation of the project as a whole, paying particular attention to whether the project has achieved its stated objectives and contributed to the broader environmental objective. It decides whether any actions are still necessary, particularly in relation to sustainability of project results and acts as a means, which lessons learned can be captured for use in other projects under implementation or formulation.

Project Monitoring Reporting

245. The national project team in conjunction with the UNIDO focal point will be responsible for the preparation and submission of the following reports that form part of the monitoring process. Items (a) through (f) are mandatory and are specifically related to monitoring, while items (g) through (h) have a broader function and the frequency and nature are to be defined throughout implementation.

(a) Inception Report

246. A Project Inception Report (IR) will be prepared immediately following the IW. It will include a detailed First Year Annual Work Plan divided into quarterly timeframes, which detail the activities and progress indicators that will guide the implementation during the first year phase of the project. The Work Plan will include the dates of specific field visits, support missions from UNIDO and/or UNIDO consultants, as well as timeframes for meetings of the project's decision-making structures. The report will also include the detailed project budget for the first full year of implementation, prepared on the basis of the Annual Work Plan, and including any monitoring and evaluation requirements to effectively measure project performance during the targeted 12 month timeframe.

247. When finalized, the report will be circulated to project counterparts, who will be given a period of one calendar month in which to respond with comments or queries. Prior to this circulation of the IR, UNIDO will review the document.

(b) Annual Project Report

248. The Annual Project Report (APR) is a UNIDO requirement and part of UNIDO central oversight, monitoring, and project management. It is a self-assessment report by project management to UNIDO, as well as a key input to the TPR. The APR will be prepared on an annual basis prior to the TPR to reflect the progress achieved in meeting the project's Annual Work Plan and assess performance of the project in contributing to the intended outcomes through outputs and partnership work.

249. The format of the APR is flexible but should include the following:
- Analysis of project performance over the reporting period, including outputs produced and information on the status of the outcome
- Constraints experienced in the progress towards results and the reasons for these
- Expenditure reports
- Lessons learned
- Recommendations to address key problems in lack of progress, if applicable.

(c) Project Implementation Review

250. The Project Implementation Review (PIR) is an annual monitoring process mandated by the GEF. It is an essential management and monitoring tool for project managers and offers the main vehicle for extracting lessons from ongoing projects. Once the project will be under

implementation for a year, the project team shall complete the PIR. The PIR can be prepared any time during the year (July-June) and ideally immediately prior to the TPR. The PIR should then be discussed at the TPR so that the result would be a PIR that has been agreed upon by project staff, the national executing agency and UNIDO.

(d) Quarterly Progress Reports

251. Short reports outlining the main updates in project progress should be provided quarterly to UNIDO by the project team.

(e) Periodic Thematic Reports

252. As and when called for by UNIDO, the project team will prepare Specific Thematic Reports, focusing on specific issues or areas of activity. The request for a Thematic Report will be provided to the project team in written form by UNIDO and will clearly state the issue or activities that need to be reported on. These reports will be used as a form of lessons learned exercise, specific oversight in key areas, or as troubleshooting exercises to evaluate and overcome obstacles and difficulties encountered.

(f) Project Terminal Report

253. During the last three months of the project, the project team will prepare the Project Terminal Report (PTR). This comprehensive report will summarize all activities, achievements and outputs of the project, lessons learned, objectives met (or not met), and structures and systems implemented. The PTR will be the definitive statement of the Project's activities during its lifetime. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's activities.

(g) Technical Reports

254. Technical Reports are detailed documents covering specific areas of analysis within the overall project. As part of the Inception Report, the project team should prepare a draft Reports List, detailing the technical reports that are expected to be prepared on key areas of activity during the course of the Project, and tentative due dates. Where necessary, this Reports List will be revised and updated and included in subsequent APRs. Technical Reports may also be prepared by external consultants and should be comprehensive, specialized analyses of clearly defined areas of research within the framework of the project and its sites. These technical reports will represent, as appropriate, the project's substantive contribution to specific areas and will be used in efforts to disseminate relevant information and best practices at local, national and international levels.

(h) Project Publication

255. Project Publications will form a key method of crystallizing and disseminating the results and achievements of the Project. These publications may be scientific or informational texts on the activities and achievements of the Project in the form of journal articles, multimedia publications or other forms of distribution. Publications can be based on Technical Reports or may be summaries or compilations of a series of Technical Reports and other research. The project team will determine if Technical Reports merit formal publication and will also (in consultation with UNIDO, the government and other relevant stakeholder groups) plan and produce these publications in a consistent and recognizable format.

Independent Evaluation

256. The project will be subjected to at least two independent external evaluations as follows:

(a) Mid-term Evaluation. An independent Mid-Term Evaluation will be undertaken at the end of the second year of project implementation. The Mid-Term Evaluation will measure progress made towards the achievement of outcomes and will identify corrections if needed. The evaluation will focus on the effectiveness, efficiency, and timeliness of project implementation; highlight issues requiring decisions and actions; and present initial lessons learned on project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the second half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this mid-term evaluation will be prepared by UNIDO in accordance with the generic TORs developed by the GEF Evaluation Office.

(b) Final Evaluation. An independent Final Evaluation will take place three months prior to the terminal tripartite project review meeting, and will focus on the same issues as the mid-term evaluation. The final evaluation will also review impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental goals. The Final Evaluation should also provide recommendations for follow-up activities. The Terms of Reference for this evaluation will be prepared by the UNIDO in accordance with the generic TORs developed by the GEF Evaluation Office.

Audit Clause

257. The Government will provide UNIDO with certified periodic financial statements and with an annual audit of financial statements relating to the status of the GEF funds according to the established procedures set out in the Programming and Finance manuals. The audit will be conducted by a legally recognized Government auditor, or by a commercial auditor engaged by the Government.

Table 4: Indicative Monitoring and Evaluation Work plan and Corresponding Budget

Type of M&E activity	Responsible Parties	Budget US$ *(Excluding project team Staff time)*	Time frame
Hold the Inception Workshop (IW)	National project management team	67,500	Within first six months of project start up
Prepare the Inception Report	National project management team supported by CTA and NTA	10,000	Immediately following IW
Measure impact indicators on an annual basis	National project management team supported by CTA and NTA	125,000	Annually
Prepare Annual Project Reports (APR) and Project Implementation Reviews (PIR)	National project management team and UNIDO supported by CTA and NTA	35,000	Annually
Hold annual tripartite review meetings	National project management team UNIDO	137,500	Every year, upon receipt of APR and PIR
Hold biannual Steering Committee meetings	National project management team UNIDO	95,000	Biannually

Type of M&E activity	Responsible Parties	Budget US$ *(Excluding project team Staff time)*	Time frame
Lessons learned	Project team	None	Annually
Carry out mid-term external evaluation	External Consultants	132,500	At the mid-point of project implementation
Carry out final external evaluation	External Consultants	132,500	At the end of project implementation
Complete the Terminal Report	National project management team and UNIDO supported by CTA and NTA	10,000	At least one month before the end of the project
Carry out annual project financial audits	Independent Audit Entity	75,000	Annually
Carry out biannual visits to selected field sites (UNIDO staff and travel costs to be charged to IA fees)	National project management team UNIDO	82,500	Biannually
TOTAL indicative COST *Excluding project team staff time and UNIDO staff and travel expenses*		**902,500**	

Table 5: Impact Measurement Template

Key Impact Indicator	Baseline	Target (at Year 5)	Means of Verification	Sampling frequency	Location
Number of medical institutions adopting BEP	0	1500	Site visit and questionnaire survey	In the mid and end	3 demonstration provinces
Number of dedicated medical waste incineration facilities meeting 0.1ng/NM^3 release limit	0	15	Site visit Sampling and lab analysis	Annually	3 demonstration provinces
Number of dedicated medical waste non-incineration treatment facilities	0	120	Site visit and questionnaire	Annually	3 demonstration provinces and nationwide
Reduction of PCDD/PCDF releases from medical waste incineration disposal	0	9.7g	Sampling and operational conditions monitoring	Annually	3 demonstration provinces
Avoided releases of PCDD/PCDF releases from medical waste treatment	0	12.95g	Operational conditions monitoring	Annually	3 demonstration provinces and nationwide
Levels of PCDD/PCDF in biological organisms in the vicinity of dedicated medical waste treatment and disposal facilities	To be determined in the first year of project implementation	To be determined in the fifth year of project implementation	Sampling and lab analysis	In the mid and end	Selected incineration facility demonstration sites

8. LESSONS LEARNED

258. Results from the project will be disseminated within and beyond the project intervention zone through a number of existing information dissemination networks and forums. New channels will be created to strengthen the knowledge sharing among the public in Public Awareness and Education Component. In addition:

- The project will participate, as relevant and appropriate, in UNIDO sponsored networks organized for Senior Personnel working on projects that share common characteristics.
- The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned.

259. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects. Identification and analysis of lessons learned is an on-going process and the need to communicate such lessons as one of the project's central contributions is a requirement to be delivered at least once in every 12 months.

9. DETAILED PROJECT BUDGET

Outcome/Output/Activity	GEF (US$)	Co-finance (US$)							Total (US$)
		UNIDO	US Gov't	MOF	MOH	SEPA	Enterprises	Co-finance Total	
Outcome 1. Strengthen the regulatory framework for medical waste management and upgrade or establish performance levels for dedicated medical waste disposal facilities	**373,785**				**73,819**	**440,476**		**514,295**	**888,080**
Output 1.1 Strengthen the regulatory framework for medical waste management	***199,815***				***73,819***	***221,456***		***295,275***	***495,090***
Activity 1.1.1 Investigate, analyze and evaluate the laws and regulations on medical wastes and their implementation	43,070				8,893	26,678		35,570	78,640
Activity 1.1.2 Adapt the related regulations to the BAT/BEP requirements	63,550				23,388	70,163		93,550	157,100
Activity 1.1.3 Hold workshop to discuss the revised drafts	42,235				6,634	19,901		26,535	68,770
Activity 1.1.4 Circulate the drafts among governmental agencies, enterprises, academia, international community, and the public for comments	26,960				19,205	57,615		76,820	103,780
Activity 1.1.5 Promulgate the adapted regulations, and introduce and implement enforcement mechanisms	24,000				15,700	47,100		62,800	86,800
Output 1.2 Upgrade or establish performance levels for dedicated medical waste disposal facilities	***173,970***					***219,020***		***219,020***	***392,990***
Activity 1.2.1 Investigate and analyze feasibility to upgrade or establish new pollution performance levels	53,400					41,400		41,400	94,800
Activity 1.2.2 Draft the upgraded pollution control levels for the incineration of health care waste to the BAT achievable performance level	35,075					50,075		50,075	85,150
Activity 1.2.3 Draft the pollution performance levels for non-incineration treatment of health care waste	35,075					50,075		50,075	85,150
Activity 1.2.4 Hold a workshop for representatives from international organizations, governments, academia, enterprises, and the public to review the proposed performance levels	14,360					19,260		19,260	33,620
Activity 1.2.5 Select 3 provinces for first pilot implementation of the upgraded performance levels						36,750		36,750	36,750
Activity 1.2.6 Revise the performance levels by incorporating the experience from the pilot implementation	21,250					8,250		8,250	29,500

Outcome/Output/Activity	GEF (US$)	Co-finance (US$)							Total (US$)
		UNIDO	US Gov't	MOF	MOH	SEPA	Enterprises	**Co-finance Total**	
Activity 1.2.7 Circulate the revised performance levels for comments and forward to SEPA for review	14,810					12,210		12,210	27,020
Activity 1.2.8 Promulgate nationwide the revised performance levels as technical standard						1,000		1,000	1,000
Outcome 2. Strengthen the institutional capacity for integrated medical waste management at national and local levels in support of the nationwide investment program	**1,409,485**		**30,000**	**1,260,125**	**1,031,713**	**1,168,348**		**3,490,185**	**4,899,670**
Output 2.1 Establish a long-term national coordination mechanism for integrated medical wastes management	***154,400***			***339,145***	***234,625***	***364,730***		***938,500***	***1,092,900***
Activity 2.1.1 Establish a national medical waste management steering group led by SEPA and MOH and composed of other relevant ministries for coordination of integrated medical waste management	47,400			30,750	15,375	15,375		61,500	108,900
Activity 2.1.2 Regularly hold coordination meetings to provide guidance and coordination on issuance of laws, regulations, standards and policies and other important issues	44,500			196,520	107,375	125,605		429,500	474,000
Activity 2.1.3 Provide guidance to the establishment and operation of local steering groups on medical waste management	62,500			111,875	111,875	223,750		447,500	510,000
Output 2.2 Strengthen supervision and inspection on medical care institutions in medical waste management	***462,450***		***30,000***	***227,363***	***797,088***	***110,000***		***1,164,450***	***1,626,900***
Activity 2.2.1 Based on Output 3.1, develop Specifications for Health Agencies to Supervise Medical Institutions in Adoption of BEP on Medical Waste Management	30,450			7,363	22,088			29,450	59,900
Activity 2.2.2 Organize health departments to have trainings on the Specifications based on the staff training system	59,000		30,000		243,000			273,000	332,000
Activity 2.2.3 Establish and implement a medical waste data reporting system between medical care institutions and authorities	205,000				422,000			422,000	627,000
Activity 2.2.4 Establish a mechanism for the local environment and health departments to regularly inspect the implementation of the BEP for medical waste management	168,000			220,000	110,000	110,000		440,000	608,000

Outcome/Output/Activity	GEF (US$)	Co-finance (US$)							Total (US$)
		UNIDO	US Gov't	MOF	MOH	SEPA	Enterprises	**Co-finance Total**	
Output 2.3 Strengthen the monitoring and supervision capacity on medical waste treatment and disposal	***514,300***			***231,700***		***231,700***		***463,400***	***977,700***
Activity 2.3.1 Develop monitoring and supervision standards and norms	333,300			130,650		130,650		261,300	594,600
Activity 2.3.2 Train the municipal monitoring and supervision staff on the application of the methods	89,700			26,400		26,400		52,800	142,500
Activity 2.3.3 Develop and implement monitoring data publishing and reporting system	45,650			37,325		37,325		74,650	120,300
Activity 2.3.4 Undertake formal quarterly inspections in pilot medical wastes disposal facilities during the project implementation period	45,650			37,325		37,325		74,650	120,300
Output 2.4 Strengthen the environmental impact assessment on disposal facilities	***171,975***			***141,538***		***141,538***		***283,075***	***455,050***
Activity 2.4.1 Develop Guideline for Environmental Impact Assessment on Health Care Disposal Facilities to include related existing or new engineering design standards and other related standards	28,175			25,638		25,638		51,275	79,450
Activity 2.4.2 Hold a training workshop on the implementation of the guideline to a qualified number of certified environmental impact assessors	78,800			83,400		83,400		166,800	245,600
Activity 2.4.3 Issue and implement the guideline nationwide on disposal facilities	65,000			32,500		32,500		65,000	130,000
Output 2.5 Strengthen the capacity to audit the operation of disposal facilities	***106,360***			***320,380***		***320,380***		***640,760***	***747,120***
Activity 2.5.1 Design and disseminate a methodology to audit disposal facilities	35,160			65,780		65,780		131,560	166,720
Activity 2.5.2 Develop accreditation and management measures for the establishment of national audit services	38,900			47,450		47,450		94,900	133,800
Activity 2.5.3 Support and encourage the existing institutions for the audit of the operation of disposal facilities	32,300			207,150		207,150		414,300	446,600
Outcome 3. Demonstrate systems management and the application of BEP	**628,125**		**50,000**	**51,100**	**1,595,275**			**1,696,375**	**2,324,500**
Output 3.1 Demonstrate BEP in medical care institutions for the lifecycle management of medical waste	***628,125***		***50,000***	***51,100***	***1,595,275***			***1,696,375***	***2,324,500***

Outcome/Output/Activity	GEF (US$)	Co-finance (US$)							Total (US$)
		UNIDO	US Gov't	MOF	MOH	SEPA	Enterprises	Co-finance Total	
Activity 3.1.1 Develop Booklet for BEP Application in Medical Institutions for pilot application based on the previously achieved experience	105,250			29,313	87,938			117,250	222,500
Activity 3.1.2 Select 20 representative medical care institutions for the demonstration program	12,125				30,875			30,875	43,000
Activity 3.1.3 Develop the demonstration program, covering procurement, waste segregation, reduction, temporary storage, and traceability	25,175		10,000		15,925			25,925	51,100
Activity 3.1.4 Establish waste management systems and carry out staff trainings on BEP application at the demonstration institutions	246,750		40,000		964,750			1,004,750	1,251,500
Activity 3.1.5 Monitor, record and evaluate the implementation process and results	126,250				376,250			376,250	502,500
Activity 3.1.6 Validate the draft booklet by incorporating lessons and experience from the evaluations, issue and disseminate the validated booklet	33,925				54,175			54,175	88,100
Activity 3.1.7 Develop Specifications on medical waste Management in Medical Institutions	78,650			21,788	65,363			87,150	165,800
Outcome 4. Demonstrate BAT for medical waste disposal using thermal combustion including air pollution monitoring	**2,432,600**		**40,000**			**5,399,800**	**5,359,800**	**10,799,600**	**13,232,200**
Output 4.1 Demonstrate the application of BAT for incineration process of medical waste	***1,262,600***		***20,000***			***2,696,800***	***2,676,800***	***5,393,600***	***6,656,200***
Activity 4.1.1 Develop a draft Booklet of BAT Application for Incineration Process of Medical waste	108,900					57,450	57,450	114,900	223,800
Activity 4.1.2 Develop a draft Specification for Construction and Operation of Medical waste Disposal Facility Using Incineration Process	82,100					49,300	49,300	98,600	180,700
Activity 4.1.3 Select one representative existing facility for demonstration	101,000					58,750	58,750	117,500	218,500
Activity 4.1.4 Carry out the feasibility study and EIA of the demonstration facility and develop the demonstration implementation plan	87,100					66,050	66,050	132,100	219,200

Outcome/Output/Activity	GEF (US$)	Co-finance (US$)							Total (US$)
		UNIDO	US Gov't	MOF	MOH	SEPA	Enterprises	Co-finance Total	
Activity 4.1.5 Retrofit and optimize the operation of the modified facility, including on-line PCDD/PCDF sampling system, and train the relevant managerial and operation staff	758,500		20,000			2,372,750	2,352,750	4,745,500	5,504,000
Activity 4.1.6 Validate the modified facility, and monitor, record and evaluate the implementation process and results	67,000					44,750	44,750	89,500	156,500
Activity 4.1.7 Validate the Booklet and the Specification by incorporating lessons and experience from the evaluation, issue and disseminate the validated Booklet and Specification	58,000					47,750	47,750	95,500	153,500
Output 4.2 Demonstrate the application of BAT in pyrolysis process of medical wastes	***1,170,000***		***20,000***			***2,703,000***	***2,683,000***	***5,406,000***	***6,576,000***
Activity 4.2.1 Develop Booklet of BAT Application in Pyrolysis Process of Medical wastes	90,900					61,950	61,950	123,900	214,800
Activity 4.2.2 Develop a draft Specification for Construction and Operation of Medical waste Disposal Facility Using Pyrolysis Process	75,100					51,050	51,050	102,100	177,200
Activity 4.2.3 Select 2 representative existing facilities for demonstration	73,900					50,450	50,450	100,900	174,800
Activity 4.2.4 Carry out the feasibility study and EIA of the demonstration facility and develop the demonstration implementation plan	80,100					59,550	59,550	119,100	199,200
Activity 4.2.5 Retrofit and optimize the operation of the modified facility, including on-line PCDD/PCDF sampling system, and train the relevant managerial and operation staff	728,500		20,000			2,374,250	2,354,250	4,748,500	5,477,000
Activity 4.2.6 Validate the modified facility, and monitor, record and evaluate the implementation process and results	63,750					53,625	53,625	107,250	171,000
Activity 4.2.7 Validate the Booklet and the Specification by incorporating lessons and experience from the evaluation, issue and disseminate the validated Booklet and Specification	57,750					52,125	52,125	104,250	162,000

Outcome/Output/Activity	GEF (US$)	Co-finance (US$)							Total (US$)
		UNIDO	US Gov't	MOF	MOH	SEPA	Enterprises	Co-finance Total	
Outcome 5. Demonstrate BAT for medical waste thermal non-combustion, chemical treatment or other appropriate non-combustion treatment	**1,984,450**					**3,667,523**	**3,932,928**	**7,600,450**	**9,584,900**
Output 5.1 Demonstrate the application of BAT in autoclaving process of medical waste	***752,000***					***1,278,250***	***1,278,250***	***2,556,500***	***3,308,500***
Activity 5.1.1 Develop Booklet of BAT Application in Autoclaving Process of Medical waste	64,950					42,225	42,225	84,450	149,400
Activity 5.1.2 Develop a draft Specification for Construction and Operation of Medical waste Disposal Facility Using Autoclaving Process	77,800					62,900	62,900	125,800	203,600
Activity 5.1.3 Select one representative existing facility for demonstration	73,900					50,450	50,450	100,900	174,800
Activity 5.1.4 Carry out the feasibility study and EIA of the demonstration facility and develop the demonstration implementation plan	90,600					82,800	82,800	165,600	256,200
Activity 5.1.5 Procure, retrofit, and operate the modified facility and train the relevant managerial and operation staff	303,750					925,875	925,875	1,851,750	2,155,500
Activity 5.1.6 Validate the modified facility, and monitor, record and evaluate the implementation process and results	67,500					55,500	55,500	111,000	178,500
Activity 5.1.7 Validate the Booklet and the Specification by incorporating lessons and experience from the evaluation, issue and disseminate the validated Booklet and Specification	73,500					58,500	58,500	117,000	190,500
Output 5.2 Demonstrate the application of BAT in other non-incineration processes of medical waste	***891,200***					***1,763,398***	***2,028,803***	***3,792,200***	***4,683,400***
Activity 5.2.1 Develop Booklet of BAT Application in Other Non-incineration Processes of Medical wastes	60,450					36,975	36,975	73,950	134,400
Activity 5.2.2 Develop a draft Specification for Construction and Operation of Medical waste Disposal Facility Using Other Non-incineration Process	75,350					51,925	51,925	103,850	179,200
Activity 5.2.3 Select 2 representative existing facilities for demonstration of microwave irradiation, chemical disinfection, or combination	60,800					34,900	34,900	69,800	130,600

Outcome/Output/Activity	GEF (US$)	Co-finance (US$)							Total (US$)
		UNIDO	US Gov't	MOF	MOH	SEPA	Enterprises	Co-finance Total	
Activity 5.2.4 Carry out the feasibility study and EIA of the demonstration facilities and develop the demonstration implementation plan	72,600					66,300	66,300	132,600	205,200
Activity 5.2.5 Procure, retrofit, and operate the modified facility and train the relevant managerial and operation staff	514,000					1,486,298	1,751,703	3,238,000	3,752,000
Activity 5.2.6 Validate the modified facility, and monitor, record and evaluate the implementation process and results	60,000					43,500	43,500	87,000	147,000
Activity 5.2.7 Validate the Booklet and the Specification by incorporating lessons and experience from the evaluation, issue and disseminate the validated Booklet and Specification	48,000					43,500	43,500	87,000	135,000
Output 5.3 Demonstrate the application of BAT/BEP for treatment and disposal of medical wastes in remote rural areas	***341,250***					***625,875***	***625,875***	***1,251,750***	***1,593,000***
Activity 5.3.1 Develop Booklet of BAT/BEP Application for Treatment and Disposal of Medical Wastes in Remote rural areas	30,250					17,375	17,375	34,750	65,000
Activity 5.3.2 Select representative remote rural areas for demonstration of the recommended BAT/BEP of the Booklet	30,250					17,375	17,375	34,750	65,000
Activity 5.3.3 Develop the demonstration implementation plan	30,250					20,375	20,375	40,750	71,000
Activity 5.3.4 Procure, install and operate the facilities and train the relevant managerial and operation staff	40,500					63,750	63,750	127,500	168,000
Activity 5.3.5 Monitor, record and evaluate the implementation process and results	168,000					451,500	451,500	903,000	1,071,000
Activity 5.3.6 Validate the Booklet by incorporating lessons and experience from the evaluation, issue and disseminate the validated Booklet	42,000					55,500	55,500	111,000	153,000

Outcome/Output/Activity	GEF (US$)	Co-finance (US$)							Total (US$)
		UNIDO	US Gov't	MOF	MOH	SEPA	Enterprises	Co-finance Total	
Outcome 6. Demonstrate spatially integrated and coordinated medical waste management and disposal systems in geographically defined clusters that include medical institutions and dedicated treatment and disposal facilities	**1,137,200**				**272,850**	**827,388**	**186,963**	**1,287,200**	**2,424,400**
Output 6.1 Demonstrate the application of integrated medical waste management among institutions at the municipal level	***524,650***				***272,850***	***273,863***	***67,938***	***614,650***	***1,139,300***
Activity 6.1.1 Select 3 demonstrations municipalities	64,450					68,950		68,950	133,400
Activity 6.1.2 Participation of project stakeholders to international symposia and undertake field visits to learn international experience in integrated medical waste management among institutions	44,150				43,575	21,788	21,788	87,150	131,300
Activity 6.1.3 Establish inter-departmental mechanisms for policy consultation and coordination for integrated medical waste management among institutions at municipal level	152,600				92,300	46,150	46,150	184,600	337,200
Activity 6.1.4 Develop municipal-level integrated medical waste management information system	119,000				67,000	67,000		134,000	253,000
Activity 6.1.5 Monitor, record and evaluate the implementation process and results	144,450				69,975	69,975		139,950	284,400
Output 6.2 Demonstrate coordinated medical waste treatment among the dedicated medical waste facilities at the provincial level	***612,550***					***553,525***	***119,025***	***672,550***	***1,285,100***
Activity 6.2.1 Select 3 demonstration provinces for coordinated medical waste management and treatment	69,450					69,450		69,450	138,900
Activity 6.2.2 Assist the selected provinces establish provincial medical waste management steering groups	64,950					64,950		64,950	129,900
Activity 6.2.3 Hold a coordinating workshop among the provincial and municipal departments and the dedicated medical waste treatment facilities	116,100					31,200	62,400	93,600	209,700
Activity 6.2.4 Develop and carry out a logistics plan for the coordinated activities	145,500					169,875	56,625	226,500	372,000

Outcome/Output/Activity	GEF (US$)	Co-finance (US$)							Total (US$)
		UNIDO	US Gov't	MOF	MOH	SEPA	Enterprises	Co-finance Total	
Activity 6.2.5 Promulgate and implement supporting policies by the local government	51,750					75,750		75,750	127,500
Activity 6.2.6 Monitor, record and evaluate the implementation process and results	164,800					142,300		142,300	307,100
Outcome 7. Develop and implement a strategy for the adoption of BAT/BEP for medical waste management and disposal	**2,565,085**			**730,495**	**1,526,344**	**3,496,466**	**77,450**	**5,830,755**	**8,395,840**
Output 7.1 Formulate techno-economic policies that promote the adoption of BAT/BEP	***337,770***			***161,425***		***161,425***		***322,850***	***660,620***
Activity 7.1.1 Investigate and analyze the needs of techno-economic policies according to the requirements of BAT/BEP and the Convention	119,400			37,500		37,500		75,000	194,400
Activity 7.1.2 Draft the needed techno-economic policies	108,000			107,050		107,050		214,100	322,100
Activity 7.1.3 Hold a policy dialogue workshop for representatives from governments, international and domestic experts, enterprises, and the public	36,570			2,625		2,625		5,250	41,820
Activity 7.1.4 Circulate the policy texts for comments	59,175			2,938		2,938		5,875	65,050
Activity 7.1.5 Incorporate the comments into the final policy texts	14,625			10,313		10,313		20,625	35,250
Activity 7.1.6 Submit the policies to SEPA and other related ministries for promulgation				1,000		1,000		2,000	2,000
Output 7.2 Demonstrate and promote different commercial models for the construction and operation of medical waste treatment and disposal facilities	***470,860***			***65,000***		***80,050***	***52,450***	***197,500***	***668,360***
Activity 7.2.1 Develop investment models to facilitate medical waste treatment and disposal	133,000			65,000				65,000	198,000
Activity 7.2.2 Conduct trainings for governmental officials and enterprises managers from at least 60 municipalities in the realization and management of medical waste management projects	84,800					11,000	22,000	33,000	117,800
Activity 7.2.3 Assist at least 20 municipalities establish medical waste management steering groups	102,800					20,900		20,900	123,700

Outcome/Output/Activity	GEF (US$)	Co-finance (US$)							Total (US$)
		UNIDO	US Gov't	MOF	MOH	SEPA	Enterprises	**Co-finance Total**	
Activity 7.2.4 Provide technical assistance to the municipalities with medical waste management steering group in adopting BOT, BOO, TOT models and etc.	39,160					5,850	5,850	11,700	50,860
Activity 7.2.5 Provide incentives to facility owners to purchase certified equipment	63,900					42,300		42,300	106,200
Activity 7.2.5 Establish technical consulting institutions to provide technical services in options for private investment	47,200						24,600	24,600	71,800
Output 7.3 Strengthen national capacity to develop new medical waste treatment technologies appropriate to China's socio-economic context	***287,700***			***423,995***		***1,271,985***		***1,695,980***	***1,983,680***
Activity 7.3.1 Identify, evaluate and establish the catalogue of processes, techniques and equipment in great demand while not yet made locally available and affordable in China	107,600			146,490		439,470		585,960	693,560
Activity 7.3.2 Hold 3 workshops for representatives from national and local governments, international technology vendors, domestic research institutes, equipment manufacturers, and medical waste treatment operators to discuss technology supplies and demands for incineration, autoclave, and other non-incineration technologies	55,700			80,600		241,800		322,400	378,100
Activity 7.3.3 Establish incentives to encourage joint development of market needed technologies and equipment by international vendors and domestic research entities	60,200			127,875		383,625		511,500	571,700
Activity 7.3.4 Establish incentives for successful application of advanced feasible technologies and equipment	86,250			69,030		207,090		276,120	362,370
Output 7.4 Develop and implement a medical waste treatment equipment certification and labeling program	***362,630***			***80,075***		***32,125***	***25,000***	***137,200***	***499,830***
Activity 7.4.1 Develop Technical Requirements for Certification and Labeling of Medical waste Treatment Equipment	22,300			10,750				10,750	33,050
Activity 7.4.2 Develop Procedures on Certification and Labeling of Medical waste Treatment Equipment	22,300			10,750				10,750	33,050

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Outcome/Output/Activity	GEF (US$)	Co-finance (US$)							Total (US$)
		UNIDO	US Gov't	MOF	MOH	SEPA	Enterprises	Co-finance Total	
Activity 7.4.3 Strengthen the capacity of certification institutions	59,450			14,625		14,625		29,250	88,700
Activity 7.4.4 Strengthen the capacity of the testing institutions and laboratories	123,780			17,500		17,500		35,000	158,780
Activity 7.4.5 Hold a series of workshops targeting separate technologies, implementation of the certification and labeling program and participation of equipment producers and investors in the program	57,550			16,550				16,550	74,100
Activity 7.4.6 Carry out pilot certification and labeling on qualified products produced by those manufacturing enterprises of better-off conditions	44,500						25,000	25,000	69,500
Activity 7.4.7 Launch extensive publicity in the medical waste treatment sector	32,750			9,900				9,900	42,650
Output 7.5 Establish training and accreditation systems for lifecycle management of medical waste that support BAT/BEP	***589,675***				***1,107,569***	***1,532,106***		***2,639,675***	***3,229,350***
Activity 7.5.1 Integrate all the experience and results from demonstrations and other external successful experience to compile textbooks for managerial and technical trainings	149,000				158,000	316,000		474,000	623,000
Activity 7.5.2 Develop various curricula to meet different training needs such as entry training, on-the-job training, refresh training, and etc.	72,930				24,310	48,620		72,930	145,860
Activity 7.5.3 Train the trainers in environmental and health sectors	276,300				778,777	874,523		1,653,300	1,929,600
Activity 7.5.4 Formulate Regulations and Resources Requirements for Medical Waste Management Training Institutions	66,445				28,148	56,297		84,445	150,890
Activity 7.5.5 Based on the existing administrative structure and training system of the health administration, establish a 4-tier personnel training system covering national, provincial, municipal, and county medical institutions	10,000				23,333	46,667		70,000	80,000

Outcome/Output/Activity	GEF (US$)	Co-finance (US$)							Total (US$)
		UNIDO	US Gov't	MOF	MOH	SEPA	Enterprises	Co-finance Total	
Activity 7.5.6 Based on the existing environmental technical training and research system, establish 3 training bases for training of dedicated medical waste treatment staff	15,000				95,000	190,000		285,000	300,000
Output 7.6 Extensive stakeholder awareness raising, including a series of national and international workshops	***516,450***				***418,775***	***418,775***		***837,550***	***1,354,000***
Activity 7.6.1 Prepare technical materials for targeted stakeholder awareness for administrators, managers and other influential players in national investment programs where the outputs of the project can potentially be replicated.	82,550				132,775	132,775		265,550	348,100
Activity 7.6.2 Launch awareness raising and education campaign to the identified stakeholders using direct communication including publications and lectures.	222,300				129,050	129,050		258,100	480,400
Activity 7.6.3 Promote academic and professional articles for envirometnally sustainable medical waste management	102,100				84,700	84,700		169,400	271,500
Activity 7.6.4 Organize a workshop at the end of this project bringing together all stakeholders and consultants/companies involved to evaluate the outcomes of the project	31,500				17,250	17,250		34,500	66,000
Activity 7.6.5 Hold a national workshop with participation from all provinces and stakeholders	31,500				30,750	30,750		61,500	93,000
Activity 7.6.6 Hold an international workshop to share the national experience with representatives from other countries and also learn from their experiences	46,500				24,250	24,250		48,500	95,000
Outcome 8. Project management, monitoring and evaluation	**1,097,220**	**100,000**		**1,758,280**				**1,858,280**	**2,955,500**
Output 8.1 Establish the project management structure	***651,000***	***50,000***		***1,175,000***				***1,225,000***	***1,876,000***

Outcome/Output/Activity	GEF (US$)	Co-finance (US$)							Total (US$)
		UNIDO	US Gov't	MOF	MOH	SEPA	Enterprises	Co-finance Total	
Activity 8.1.1 Establish the Steering Committee by drawing upon resources from related ministries or commissions at the national level, and from local governmental agencies	50,000			100,000				100,000	150,000
Activity 8.1.2 Establish the National Project Management Team under CIO	10,000			550,000				550,000	560,000
Activity 8.1.3 Recruit a CTA, a NTA, policy experts, technical experts in medical waste management, and evaluation and programming experts to form a project expert team	426,250	50,000		206,250				256,250	682,500
Activity 8.1.4 Establish 3 local PMOs in selected provinces for intensive demonstrations	5,000			275,000				275,000	280,000
Activity 8.1.5 Carry out a series of management training classes to the national and local project management staff	159,750			43,750				43,750	203,500
Output 8.2 Design and implement an M&E mechanism according to GEF M&E procedures	***446,220***	***50,000***		***583,280***				***633,280***	***1,079,500***
Activity 8.2.1 Hold the Inception Workshop	23,750			43,750				43,750	67,500
Activity 8.2.2 Prepare the Inception Report	5,000			5,000				5,000	10,000
Activity 8.2.3 Measure impact indicators on an annual basis	25,000			100,000				100,000	125,000
Activity 8.2.4 Prepare Annual Project Reports and Project Implementation Reviews	5,000	25,000		5,000				30,000	35,000
Activity 8.2.5 Hold annual tripartite review meetings	57,500	20,000		60,000				80,000	137,500
Activity 8.2.6 Hold biannual Steering Committee meetings	47,500			47,500				47,500	95,000
Activity 8.2.7 Carry out mid-term external evaluation	81,250			51,250				51,250	132,500
Activity 8.2.8 Carry out final external evaluation	81,250			51,250				51,250	132,500
Activity 8.2.9 Complete the Terminal Report	5,000	5,000						5,000	10,000

Outcome/Output/Activity	GEF (US$)	Co-finance (US$)							Total (US$)
		UNIDO	US Gov't	MOF	MOH	SEPA	Enterprises	**Co-finance Total**	
Activity 8.2.10 Carry out annual project financial audits	58,250			16,750				16,750	75,000
Activity 8.2.11 Carry out biannual visits to selected field sites	37,500			45,000				45,000	82,500
Activity 8.2.12 Establish a project management information system (MIS), including a project website to disseminate information to various stakeholders	19,220			157,780				157,780	177,000
TOTAL PROJECT COSTS	**11,650,0000**	**100,000**	**120,000**	**3,800,000**	**4,500,000**	**15,000,000**	**9,557,140**	**33,077,140**	**44,727,140**

10. PROJECT WORK PLAN

Outcome/Output/Activity		Y1				Y2				Y3				Y4				Y5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Outcome 1	**Strengthen the regulatory framework**																				
Output 1.1	***Strengthen the regulatory framework for MW management***																				
Activity 1.1.1	Investigate, analyze and evaluate laws and regulations																				
Activity 1.1.2	Adapt related regulations to BAT/BEP requirements																				
Activity 1.1.3	Hold workshop to discuss revised drafts																				
Activity 1.1.4	Circulate drafts among governmental agencies, enterprises, academia, international community and public for comments																				
Activity 1.1.5	Promulgate adapted regulations, introduce and implement enforcement mechanisms																				
Output 1.2	*Upgrade or establish performance levels for dedicated medical waste disposal facilities*																				
Activity 1.2.1	Investigate and analyze feasibility to upgrade or establish new pollution performance levels																				
Activity 1.2.2	Draft the upgraded pollution control levels over incineration of medical waste to BAT achievable performance level																				
Activity 1.2.3	Draft the pollution performance levels for non-incineration treatment of medical waste																				
Activity 1.2.4	Hold a workshop with representative from international organization, relevant government agencies, academia, enterprises and public to review proposed performance levels																				
Activity 1.2.5	Select 3 provinces for first pilot implementation of the upgraded performance levels																				
Activity 1.2.6	Revise the performance levels by incorporating the experience from the pilot implementation																				
Activity 1.2.7	Circulate the revised performance levels for comments and forward to SEPA for review																				
Activity 1.2.8	Promulgate the revised performance levels nationwide as technical standard																				
Outcome 2	**Strengthen institutional capacity for integrated medical waste management at national and local levels in support of Nationwide Investment Plan**																				
Output 2.1	*Establish a long-term national coordination mechanism for integrated MW management*																				
Activity 2.1.1	Establish a national MW management steering group composed of relevant ministries for coordination of integrated MW management																				

Outcome/Output/Activity		Y1				Y2				Y3				Y4				Y5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 2.1.2	Regularly hold coordination meetings to provide guidance and coordination on issuance of laws, regulations, standards and policies as well as other important issues																				
Activity 2.1.3	Provide guidance to the establishment and operation of local steering groups on MW management																				
Output 2.2	*Strengthen supervision and inspection on medical care institutions in MW management*																				
Activity 2.2.1	Develop specifications for Health Agencies to supervise MIs in adoption of BEP on MW management, based on Output 3.1																				
Activity 2.2.2	Organize health departments to have trainings on Specifications based on staff training system established by Output 7.4																				
Activity 2.2.3	Establish and implement a MW data reporting system between MIs and authorities																				
Activity 2.2.4	Establish a mechanism for local environment and health departments to regularly inspect implementation of BEP for MW management																				
Output 2.3	*Strengthen the monitoring and supervision capacity on MW treatment and disposal*																				
Activity 2.3.1	Develop monitoring and supervision standards and norms																				
Activity 2.3.2	Train the municipal monitoring and supervision staff on application of methods																				
Activity 2.3.3	Develop and implement monitoring data publishing and reporting system																				
Activity 2.3.4	Undertake formal quarterly inspections in pilot MW disposal facilities																				
Output 2.4	*Strengthen the EIA on disposal facilities*																				
Activity 2.4.1	Develop Guideline for EIA on Medical Disposal Facilities to include related existing or new engineering design standards and other related standards																				
Activity 2.4.2	Hold training workshop on implementation of guideline to a qualified number of certified environmental impact assessors																				
Activity 2.4.3	Issue and implement guideline nationwide on disposal facilities																				
Output 2.5	*Strengthen capacity to audit the operation of disposal facilities*																				
Activity 2.5.1	Design and disseminate a methodology to audit disposal facilities																				
Activity 2.5.2	Develop accreditation and management measures for establishment of national audit services																				
Activity 2.5.3	Support and encourage the existing institutions for audit of the operation of disposal facilities																				

Outcome/Output/Activity		Y1				Y2				Y3				Y4				Y5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Outcome 3	**Demonstrate BEP based management including measurement and monitoring**																				
Output 3.1	*Demonstrate BEP in medical care institutions for the management of medical waste*																				
Activity 3.1.1	Develop Specifications on MW management in MIs																				
Activity 3.1.2	Develop Booklet for BEP Application in MIs for pilot application based on the previously achieved experience																				
Activity 3.1.3	Select 20 representative medical care institutions for the demonstration program																				
Activity 3.1.4	Develop the demonstration program, covering procurement, waste segregation, reduction, temporary storage, transportation and traceability																				
Activity 3.1.5	Establish waste management systems and carry out staff trainings on BEP application at the demonstration institutions																				
Activity 3.1.6	Monitor, record and evaluate the implementation process and results																				
Activity 3.1.7	Validate the draft booklet by incorporating lessons and experience from the evaluations, issue and disseminate the validated booklet																				
Outcome 4	**Demonstrate BAT for medical waste disposal using thermal combustion including air pollution monitoring**																				
Output 4.1	***Demonstrate the application of BAT for incineration process of MW***																				
Activity 4.1.1	Develop a draft Booklet of BAT Application for Incineration Process of MW																				
Activity 4.1.2	Develop a draft Specification for Construction and Operation of MW Disposal Facility Using Incineration Process																				
Activity 4.1.3	Select one representative existing facility for demonstration																				
Activity 4.1.4	Carry out feasibility study and EIA of the demonstrative facility and develop the demonstration implementation plan																				
Activity 4.1.5	Retrofit and optimize the operation of the modified facility, including on-line PCDD/PCDF sampling system, and train the relevant managerial and operation staff																				
Activity 4.1.6	Validate the modified facility and monitor, record and evaluate the implementation process and results																				
Activity 4.1.7	Validate the Booklet and the Specification by incorporating lessons and experience from the evaluation, issue and disseminate the validated Booklet and Specification																				
Output 4.2	***Demonstrate the application of BAT in pyrolysis process of MW***																				
Activity 4.2.1	Develop Booklet of BAT application in pyrolysis process of MW																				

Outcome/Output/Activity		Y1				Y2				Y3				Y4				Y5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 4.2.2	Develop a draft Specification for Construction and Operation of MW Disposal Facility Using Pyrolysis Process																				
Activity 4.2.3	Select 2 representative existing facilities for demonstration																				
Activity 4.2.4	Carry out the feasibility study and EIA of the demonstration facility and develop the demonstration implementation plan																				
Activity 4.2.5	Retrofit and optimize the operation of the modified facility, including on-line PCDD/PCDF sampling system and train the relevant managerial and operation staff																				
Activity 4.2.6	Validate the modified facility and monitor, record and evaluate the implementation process and results																				
Activity 4.2.7	Validate the Booklet and the Specification by incorporating lessons and experience from the evaluation, issue and disseminate the validated Booklet and Specification																				
Outcome 5	**Demonstrate BAT/BEP for MW thermal non-combustion treatment or other appropriate non-combustion treatment**																				
Output 5.1	***Demonstrate the application of BAT in autoclaving process of MW***																				
Activity 5.1.1	Develop Booklet of BAT Application in Autoclaving Process of MW																				
Activity 5.1.2	Develop a draft Specification for Construction and Operation of MW Disposal Facility Using Autoclaving Process																				
Activity 5.1.3	Select one representative existing facility for demonstration																				
Activity 5.1.4	Carry out the feasibility study and EIA of the demonstrative facility and develop the demonstration implementation plan																				
Activity 5.1.5	Procure, retrofit, and operate the modified facility and train the relevant managerial and operation staff																				
Activity 5.1.6	Validate the modified facility and monitor, record and evaluate the implementation process and results																				
Activity 5.1.7	Validate the Booklet and the Specification by incorporating lessons and experience from the evaluation, issue and disseminate the validated Booklet and Specification																				
Output 5.2	*Demonstrate the application of BAT in other non-incineration processes of MW*																				
Activity 5.2.1	Develop Booklet of BAT Application in other non-incineration Processes of MW																				
Activity 5.2.2	Develop a draft Specification for Construction and Operation of MW Disposal Facility Using Other Non-incineration Process																				

Outcome/Output/Activity		Y1				Y2				Y3				Y4				Y5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 5.2.3	Select 2 representative existing facilities for demonstration of microwave irradiation, chemical disinfection or combination																				
Activity 5.2.4	Carry out the feasibility study and EIA of the demonstration facilities and develop the demonstration implementation plan																				
Activity 5.2.5	Procure, retrofit and operate the modified facility and train the relevant managerial and operation staff																				
Activity 5.2.6	Validate the modified facility and monitor, record and evaluate the implementation process and results																				
Activity 5.2.7	Validate the Booklet and the Specification by incorporating lessons and experience from the evaluation, issue and disseminate the validated Booklet and Specification																				
Output 5.3	*Demonstrate the application of BAT/BEP for treatment and disposal of MWs in remote rural areas*																				
Activity 5.3.1	Develop Booklet of BAT/BEP Application for Treatment and Disposal of MWs in remote rural areas																				
Activity 5.3.2	Select representative remote rural areas for demonstration of the recommended BAT/BEP of the Booklet																				
Activity 5.3.3	Develop the demonstration implementation plan																				
Activity 5.3.4	Procure, install and operate the facilities and train the relevant managerial and operation staff																				
Activity 5.3.5	Monitor, record and evaluate the implementation process and results																				
Activity 5.3.6	Validate the Booklet by incorporating lessons and experience from the evaluation, issue and disseminate the validated Booklet																				
Outcome 6	**Demonstrate spatially integrated and coordinated medical waste management and disposal systems in geographically defined clusters that include medical institutions and dedicated treatment and disposal facilities**																				
Output 6.1	*Demonstrate the application of integrated MW management among institutions at the municipal level*																				
Activity 6.1.1	Select 3 demonstrations municipalities																				
Activity 6.1.2	Participation of project stakeholders to international symposia and undertake field visits to learn international experience in integrated medical waste management among institutions																				
Activity 6.1.3	Establish inter-departmental mechanisms for policy consultation and coordination for integrated MW management among institutions at municipal level																				
Activity 6.1.4	Develop municipal level integrated MW management information system																				

Outcome/Output/Activity		Y1				Y2				Y3				Y4				Y5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 6.1.5	Monitor, record and evaluate the implementation process and results																				
Output 6.2	*Demonstrate coordinated MW treatment among the dedicated MW facilities at the provincial level*																				
Activity 6.2.1	Select 3 demonstration provinces for coordinated MW management and treatment																				
Activity 6.2.2	Assist selected provinces establish provincial MW management steering groups																				
Activity 6.2.3	Hold a coordinating workshop among the provincial and municipal departments and the dedicated MW treatment facilities																				
Activity 6.2.4	Develop and carry out a logistics plan for the coordinated activities																				
Activity 6.2.5	Promulgate and implement supporting policies by the local government																				
Activity 6.2.6	Monitor, record and evaluate the implementation process and results																				
Outcome 7	**Develop and implement a strategy for the adoption of BAT/BEP for MW management and disposal**																				
Output 7.1	*Formulate techno-economic policies that promote the adoption of BAT/BEP*																				
Activity 7.1.1	Investigate and analyze the needs of techno-economic policies according to the requirements of BAT/BEP and the Convention																				
Activity 7.1.2	Draft the needed techno-economic policies																				
Activity 7.1.3	Hold a policy dialogue workshop for representatives from governments, international and domestic experts, enterprises and the public																				
Activity 7.1.4	Circulate the policy texts for comments																				
Activity 7.1.5	Incorporate the comments into the final policy texts																				
Activity 7.1.6	Submit the policies to SEPA and other related ministries for promulgation																				
Output 7.2	*Demonstrate and promote different commercial models for the construction and operation of MW treatment and disposal facilities*																				
Activity 7.2.1	Develop investment models to facilitate MW treatment and disposal																				
Activity 7.2.2	Conduct trainings for government officials and enterprises managers from at least 60 municipalities in the realization and management of MW management projects																				
Activity 7.2.3	Assist at least 20 municipalities establish MW management steering groups																				

Outcome/Output/Activity		Y1				Y2				Y3				Y4				Y5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 7.2.4	Provide technical assistance to the municipalities with MW management steering group in adopting BOT, BOO, TOT models, etc.																				
Activity 7.2.5	Provide incentives to facility owners to purchase certified equipment																				
Activity 7.2.6	Establish technical consulting institutions to provide technical services in options for private investment																				
Output 7.3	*Strengthen national capacity to develop new MW treatment technologies appropriate to China's socio-economic context*																				
Activity 7.3.1	Identify, evaluate and establish the catalogue of processes, techniques and equipment in great demand while not yet made locally available and affordable in China																				
Activity 7.3.2	Hold 3 workshops for representatives from national and local governments, international technology vendors, domestic research institutes, equipment manufacturers, and medical waste treatment operators to discuss technology supplies and demands for incineration, autoclave, and other non-incineration technologies																				
Activity 7.3.3	Establish incentives to encourage joint development of market needed technologies and equipment by international vendors and domestic research entities																				
Activity 7.3.4	Establish incentives for successful application of advanced feasible technologies and equipment																				
Output 7.4	*Develop and implement a MW treatment equipment certification and labeling program*																				
Activity 7.4.1	Develop Technical Requirements for Certification and Labeling of MW Treatment Equipment																				
Activity 7.4.2	Develop Procedures on Certification and Labeling of MW Treatment Equipment																				
Activity 7.4.3	Strengthen the capacity of certification institutions																				
Activity 7.4.4	Strengthen the capacity of the testing institutions and laboratories																				
Activity 7.4.5	Hold series of workshops targeting separate technologies, implementation of the certification and labeling program, and participation of equipment producers and investors in the program																				
Activity 7.4.6	Carry out pilot certification and labeling on qualified products produced by those manufacturing enterprises of better-off conditions																				
Activity 7.4.7	Launch extensive publicity in the MW treatment sector																				
Output 7.5	*Establish training and accreditation systems for lifecycle management of MW that support BAT/BEP*																				

Outcome/Output/Activity		Y1				Y2				Y3				Y4				Y5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 7.5.1	Integrate all experiences and results from demonstrations and other external successful experience to compile textbooks for managerial and technical trainings																				
Activity 7.5.2	Develop various curricula to meet different training needs such as entry training, on-the-job training, refresh training, etc.																				
Activity 7.5.3	Train the trainers in environmental and health sectors																				
Activity 7.5.4	Formulate Regulations and Resources Requirements for MW Management Training Institutions																				
Activity 7.5.5	Based on the existing administrative structure and training system of the health administration, establish a 4-tier personnel training system covering national, provincial, municipal and county MIs, including establishment of 7 training bases for high-level managerial and technical staff in health agencies and MIs																				
Activity 7.5.6	Based on the existing environmental technical training and research system, establish 3 training bases for training of dedicated MW treatment staff																				
Output 7.6	*Extensive stakeholder awareness raising, including a series of national and international workshops*																				
Activity 7.6.1	Prepare technical materials for targeted stakeholder awareness for administrators, managers and other influential players in national investment programs where the outputs of the project can potentially be replicated.																				
Activity 7.6.2	Launch awareness raising and education campaign to the identified stakeholders using direct communication including publications and lectures.																				
Activity 7.6.3	Promote academic and professional articles for enviromet nally sustainable medical waste management																				
Activity 7.6.4	Organize a workshop by the end of this project bringing together all stakeholders and consultants/companies involved to evaluate the Outcomes of the project																				
Activity 7.6.5	Hold a national workshop with participation from all provinces and stakeholders																				
Activity 7.6.6	Hold an international workshop to share the national experience with representatives from other countries and also learn from their experiences																				
Outcome 8	**Project management, monitoring and evaluation**																				
Output 8.1	*Establish the project management structure*																				
Activity 8.1.1	Establish the Steering Committee by drawing upon resources from related ministries or commissions at the national level and from local governmental agencies																				
Activity 8.1.2	Establish the National Project Management Team under CIO																				

Outcome/Output/Activity		Y1				Y2				Y3				Y4				Y5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 8.1.3	Recruit a CTA, a NTA, policy experts, technical experts in medical waste management, and evaluation and programming experts to form an expert team																				
Activity 8.1.4	Establish 3 local PMOs in selected provinces for intensive demonstrations																				
Activity 8.1.5	Carry out a series of management training classes to the national and local project management staff																				
Output 8.2	*Design and implement an M&E mechanism according to GEF M&E procedures*																				
Activity 8.2.1	Hold the Inception Workshop																				
Activity 8.2.2	Prepare the Inception Report																				
Activity 8.2.3	Measure impact indicators on an annual basis																				
Activity 8.2.4	Prepare Annual Project Reports and Project Implementation Reviews																				
Activity 8.2.5	Hold annual tripartite review meetings																				
Activity 8.2.6	Hold biannual Steering Committee meetings																				
Activity 8.2.7	Carry out mid-term external evaluation																				
Activity 8.2.8	Carry out final external evaluation																				
Activity 8.2.9	Complete the Terminal Report																				
Activity 8.2.10	Carry out annual project financial audits																				
Activity 8.2.11	Carry out biannual visits to selected field sites																				
Activity 8.2.11	Establish a project management information system (MIS), including a project website to disseminate information to various stakeholders																				

ANNEXES:

Annex 1: INTERNATIONAL EXPERIENCE IN MEDICAL WASTE MANAGEMENT

Annex 2: FEE-BASED MEDICAL WASTE SYSTEM

Annex 3: IDENTIFICATION AND RESPONSIBILITIES OF STAKEHOLDERS

Annex 4: TERMS OF REFERENCES

Annex 5: BUSINESS PLAN

ANNEX 1: INTERNATIONAL EXPERIENCE IN MEDICAL WASTE MANAGEMENT

INTRODUCTION

Developed countries have been facing with the issue of health care waste management for many years and set up appropriate managing rules and a broad range of sound disposal techniques in order to minimize the risks. In developing countries, the positive and favored expansion in health care systems and services has resulted in a sensible increase of the amount of the wastes generated, the use of disposable single-use items with an increase in the amount of packaging of health care products and therefore an increased concern about risks for human health and emission of pollutants.

The main problems consist in inadequate or even non-existent management systems and in the use of poor disposal technologies, in large part of small and old incinerators. Sometimes the principal method of disposal remains the insecure dumping. However, some of these improvements especially for retrofitting of incineration plants with abatement devices are very expensive, since very strict regulatory limits have been introduced and monitoring systems have been set to control the emissions of the most toxic pollutants. For this reason, the use of dedicated medical waste incinerators is rapidly declining in most highly industrial countries in favor of non-combustion technologies or centralized plants.

In developing countries, even where new facilities can be introduced, the lack of a strong regulatory infrastructure and less stringent emission limits make them an attractive market for vendors of dedicated medical waste incinerators and therefore a very small fraction of new disposal plants is formed by non-combustion technologies. Additionally, it must be pointed out that many developing countries do not have the facility to either monitor or regulate PCDD/PCDF and mercury, so there are only limited data for these pollutants. While in industrialized countries, data on environmental releases from medical waste incinerators are available. For this additional reason, the pollutant emission must be avoided through the adoption of cleaner technologies, processes and practices as well as waste minimization.

EUROPE

The European Union (EU) has a framework for coordinating waste management within the Community in order to limit the generation of waste. The main Directives are:

- Directive 75/442/EC on waste and its amendments.
- Directive 91/689/EC on hazardous waste and its amendments.
- Regulation 259/93/EC on the supervision and control of shipments of waste within, into and out of the EC
- Directive 2000/76/EC on waste incineration
- Directive 61/96/EC IPPC (Integrate Pollution Prevention and Control Directive)

Health care wastes are listed under Category 18 of the new European Waste Catalogue (CER), which came into force on 1st January 2002 (with Decision of the European Commission 2000/532/CE).

As far as the health care waste disposal is concerned, the European Directive 2000/76/EC was introduced with the aim to prevent or reduce, as far as possible, air, water and soil pollution caused by the incineration or co-incineration of all kinds of wastes, as well as the resulting risk to human health. The Directive set stricter emission limits for medical waste incinerators. This had the effect of a wide closure of many incinerators and, conversely, in an increase of the use combustion technology for the disposal of infectious waste, although the introduction of these alternative treatments is slower than in the USA and incineration remains the prevailing method of treating health care waste in Europe. In most of the new countries, which recently joined the EU, even to date, health care waste is most

probably combusted to a large extent in small and old facilities located on-site at the hospitals and not complying with EU emission limits for incinerators of 0.1 ngTEQ/Nm^3. However, there is generally a move towards larger, centralized facilities as in most developed European countries.

Only few countries of the EU banned the use of incineration and converted to non-combustion methods. Some case studies are reported

Medical waste management in Ireland

Ireland has decided to treat medical waste by a non-incineration technology. Until recently, approximately 50% of healthcare waste was incinerated on-site and 50% landfilled. With the current trends, both national and international, there is considerable pressure on the healthcare sector to shut down hospital incinerators and find alternative ways of dealing with wastes. At the present time, there are only two hospitals with licensed incinerators, both of which have not been in operation for the past several years. It is anticipated that the last two medical waste incinerators will be unlicensed and dismantled following the 150 other incinerators that at one time existed in Ireland.

In a recent development, a joint Irish North/South Body, Joint Waste Management Board contracted Sterile Technologies Ireland, a private waste management company, for dealing with medical waste in Ireland.

Sterile Technologies Ireland use a STI Model 2000 process in shredding waste prior to treatment followed by the injection of steam, for a complete elimination of pathogenic micro-organisms. Key parameters are continuously monitored and recorded providing for a safe, clean and accountable process of healthcare waste. The unrecognizable waste is held pending for verification and scientifically defined as sterile before sending to dumping site.

The current position in Ireland is that 95% of all medical waste treated on the island receives segregation at source into specific disposal streams of domestic and medical waste. The medical waste is stored in wheeled bins at each hospital facility and transported with electronic tracking from its point of production to its final disposal. This way of dealing with medical waste changed the perception that incineration was the only safe method for healthcare waste disposal.

A detailed explanation of this new technology through workshops helped the introduction of the system to hospitals and aided segregation of waste at source, dealing with the documentation, dedicated collection points and the wheeled bins used at each facility.

The waste, which is not acceptable using the STI Model 2000 process, falls under two categories.

Firstly, packaging that is not sealed properly, which is damaged, holed or leaking and packaging, which does not have an identifiable cable tie attached and not labeled to denote source and contents. This category if managed can change and be processed. The second category is waste that cannot be processed using the STI Model 2000 processing system.

Cytotoxic, sharp and non-sharp waste, recognizable anatomical waste i.e. limbs, organs, waste containing Hazard Group 4 pathogens, making approximately 3% of the overall medical waste in Ireland is exported to an incinerator in Belgium.

Medical waste management in Portugal

Until 1995, environmentally sound medical waste management in Portugal was virtually non-existent. Legislation divided medical waste only in two categories: Non-hazardous waste and hazardous waste. There was a very weak source separation system and as a result 50% of the waste (25,000 t/year) was considered hazardous. The final destinations of the hazardous waste were 40 on-site medical waste incinerators. The environmental performance of these incinerators was very poor. The combustion chamber temperature of most of them was below 800°C. They did not have any kind of flue gas treatment systems and no air pollution monitoring was in place. Due to the public pressure, in 1996 the Government approved a new legislation that finally allowed the autoclaving of infectious waste. In

1998 the Government approved the National Plan for medical waste with the target of phasing out 30 existing incinerators, keeping only one or two incinerators for the whole country in 2000. In 2003 and 2004 two of the last three medical waste incinerators were closed.

The amount of hazardous medical waste has been steadily decreasing since 1995 (25,000 t in 1995, 16,469 t in 2001, and 15,336 t in 2002) due to a better segregation of waste. From 1996 to 1998, two big autoclaves were built, which nowadays treat more than 80% of the total hospital hazardous waste produced in Portugal.

The legislation from 1996 categorizes medical waste of Group III and IV as hazardous. For category IV waste incineration is compulsory (the category III waste could be autoclaved), therefore the correct separation of waste groups III and IV is essential. About 20% of hazardous medical was incinerated in 2002, but the amount of Group IV waste represents only some 5% of the total waste in hospitals where a more serious segregation policy is in place.

Medical waste management in Italy

As EU member, Italy based its waste management laws and regulations on the relevant EU framework directives. One of the most important laws is the Legislative Decree 22/97 on industry and hazardous waste adopted in 1997. The waste management laws and regulations system has developed a full and detailed list of categories. The different articles of this law, referring the above EU directives, formulated stricter and more detailed regulations on waste management in Italy.

Medical waste management in Denmark

In Denmark, the dominant part of healthcare risk waste generated is incinerated together with municipal solid waste in 7 of the ordinary municipal waste incineration plants. All small incineration plants previously operating at hospitals have been closed.

Danish investigations have concluded that incineration of healthcare risk waste together with ordinary solid waste do not seem to influence PCDD/PCDF emission to air from ordinary waste incineration. The emission from healthcare risk waste in that context is thus assumed to be included in the figures stated for waste incineration. Only 7 plants have established special PCDD/PCDF filters with charcoal/coal dust for treatment of the flue gas besides the normal flue gas cleaning equipment. The filter material with its content of PCDD/PCDF is disposed of into the oven. However, one small plant incinerating partly chemical waste and partly healthcare risk waste is in operation. This plant treats approximately 4,000 tons waste per year. The plant is equipped with bag filter, but has no special PCDD/PCDF filter. 2 measurements from 1999 gave results of 1.4 and 5.8 ng N-TEQ/Nm^3 respectively. Assuming 6 Nm^3/kg waste and that an N-TEQ may be considered equal to I-TEQ, the yearly emission to air can be calculated as 34 – 140 mg I-TEQ/year. The amount of PCDD/PCDF collected with the residues of filter dust is assessed as insignificant compared with residues from municipal waste incineration.

CASE STUDIES IN EUROPE

Integrated waste management in an Italian hospital

An Italian Hospital located in Rome has been chosen as an example of well-integrated waste management and disposal of medical wastes.

The hospital is specialized in the neuro-motor rehabilitation of patients suffering from different diseases (strokes, amputations, paraplegia, etc.). The hospital produces roughly 42 kg/day per 1.260 kg/month. The waste originating from the activities of the hospital can be classified as special (those from long-term stay) and hazardous (those from research laboratories) but it also includes municipal waste not coming from medical activities.

More generally, waste originated from medical activities can be divided into:

(1) Not Hazardous Medical Waste, (2) Not Infective Hazardous Medical Waste, (3) Infective Hazardous Medical Waste, (4) Medical Waste Assimilated To Municipal Waste, (5) Medical Waste Requiring Special Management Systems.

Collection and Segregation system

Collection takes place at the Operational Units and Services under monitoring of the Senior Nurse, the co-coordinators of the gym, swimming-pool and radiology and of the technicians of analysis and research laboratory that will organize, with the help of the person-in-charge of the appointed Firm, a system of local differentiated collection:

- Black Bags for not hazardous medical waste and for medical waste assimilated to municipal waste are placed in Municipal Company containers for transportation to dumping site, which are personally managed by the assistance staff. Bags must be closed with a plaster on which the name of the originating Unit must be written;
- Liquid waste from meals are not placed together with municipal waste;
- Expired medicines are periodically sent to the pharmacy for temporary storage, in order to be placed in a rigid container like that for hazardous waste with written “expired medicines”;
- Empty toner cartridges of photocopy machines and printers are handed to Bursary Office for disposal through external authorized enterprise;
- Exhausted batteries are placed in a small container and periodically placed by the ancillary staff directly into the appropriate container;
- Infective risk hazardous medical waste is collected in the appropriate containers with a system of double packaging made by a strengthened plastic bag (internal container) and a rigid external disposable one. On the cover of the rigid external container the requested details is specified.
- Sharps or cutting items are placed in appropriate yellow plastic rigid containers avoiding any manipulation: the color yellow indicates hazard;
- Films or photographic sheets are kept at the Radiology Service to be periodically discarded through the authorized Firm;
- The corpses of pacemaker holders, to be cremated, undergo the removal of the device by the necropsy doctor. The pace-maker becomes hazardous medical waste at all effects and it is treated as such also for a potential recovery;
- Radioactive waste coming from research laboratories is stored in the appropriate area and periodically discarded through authorized company;
- Materials coming from building construction or demolition activities are taken away with an appropriate authorized vehicle to be sent to inert dumping site;
- Various material are taken away and sent to dumping site of not hazardous waste, with an appropriate vehicle authorized for the transportation;
- Laboratory liquid wastes are collected in special tanks provided by the enterprise authorized and periodically disposed of into the authorized dumping site.

The containers dedicated to the collection of waste are divided with different colors:

- containers for waste assimilated to municipal waste (large green garbage bins) provided by Municipal Company;
- containers for the collection of paper (large white garbage bin) provided by Municipal Company;
- containers for collection of glass and aluminum (large blue garbage bin) provided by Municipal Company;

- containers for the collection of exhausted batteries (small white bin) provided by Municipal Company and located in the yard of the hospital;
- containers for the collection of cardboard packing (large white bin) provided by Municipal Company and located near the former Pharmacy;
- container for the collection of hazardous medical waste located near the laundry;
- containers for gardening waste, located near the former Pharmacy;
- containers for municipal waste dedicated to waste originated from maintenance (municipal waste garbage bin).

It is planned to increase the number of such containers and to place them in several sites within the Hospital.

Internal Transportation

The staff, wearing single-use gloves for transportation and closing the plastic bags in order to protect their hands, uses appropriate trolleys for the transportation of bags and not those destined to the normal activities of the Operational Unit. The staff of the Operational Units avoids placing the waste produced by each Unit out of the room set up for temporary storage too long before arrival time of the ancillary staff in charge of its transportation to the collection containers.

The Medical Director, as producer and/or holder of hazardous waste, according to European Regulations, has a register for load and unloads with numbered pages stamped by the Register Office, on which to note all information on quantitative and qualitative aspects of waste. Such notes must be written on the register within one week from production of waste and from unload**.**

Temporary Storage

Area where waste is stored is periodically cleaned and disinfected. Only the Medical Director and the Transportation Company worker have the key of the Storage Room. The first storage phase of medical waste is within the Operational Units. The collection of waste takes place more than once a day by the ancillary staff of the Operational Unit, avoiding contact with the public. The operator does not transport packed waste on which the origin identification label is not compiled in all its parts because any omission to the above-mentioned rule will turn into a disciplinary dispute for the operator and for the relative Senior Nurse of the Operational Unit or of the co-coordinator of the gym, swimming-pool and radiology or of the technicians of the analysis and research laboratories.

Temporary and preliminary storage of infective risk medical waste has a maximum duration of 5 days from the moment of closing of the container, and the writing on the register of load and unload must be within 5 days from the date of temporary storage, extended to 30 days for quantities less than 200 liters. Temporary storage is carried out in conditions such not to cause alterations that can be health hazardous using appropriate areas and rooms.

Transport of waste

Waste is sent every day to incinerator plant, while recycled, re-used or recovered waste is sent to recovery plants. The Medical Director produces also four copies, date and sign a waste identification form (WIF), countersigned by the transporters, which keeps a copy. The remaining three copies of the form accompany the waste during transportation and, countersigned and dated on arrival to destination, is taken one by the receiver and the other two by the transporters, who gives one back to the holder (Medical Director), confirming the arrival to the dumping site. In the waste identification form there is: the name and address of the producer; the origin, the type and quantity of waste, the date and trail and the name and address of receiver. The Office for Public Relations kept the forms together with the registers of load and download.

In case after three months from disposal, the copy of identification form stamped by the person in charge of disposal is not returned, the Medical Director notifies it to the Province, in case of Special Waste, or to the Region in case of Hazardous Waste. Registers are integrated with the forms relative to the transportation of waste and are kept at the Medical Directorate for five years from the date of the last registration. It is necessary to be certain of the quantity of special waste, to check its correspondence with the quantities written in the load and download register, and the Medical Directorate is in charge of checking this correspondence.

Training

They are carried out through meetings open to the Senior Nurse, the Co-coordinators of the gym, swimming pool and radiology and the Technicians responsible for the laboratories of analysis and research, the heads of service and all the operators involved in the management of medical waste, in order to improve their knowledge on the subject. The staff of the enterprise appointed for the disposal must participate at these meetings.

Recovery

The hospital produces many items that can be recycled, re-used or recovered, such as:

- Glass containers for medicines, food, drinks, infusion solutions without cannulas or needles visibly not contaminated with blood, not radioactive and not coming from patients in infective isolation;
- Other waste for packing in glass, paper and cardboard, plastic or metal excluding the hazardous ones (e.g. empty medicine boxes, magazines and newspapers, residues administrative activities, paper bags);
- Not hazardous metal waste;
- Gardening waste;
- Waste originating from the preparation of meals;
- Non-delivered radiological fixing liquids;
- Mineral, vegetal and fat oils;
- Exhausted batteries;
- Toners of photocopy and fax machines, laser printers;
- Mercury;
- Films and photographic sheets.

All these waste items are sent to dedicated and authorized recovery plants.

Disposal in incinerator

The majority of medical waste (both the hazardous and not hazardous waste) is sent to Rome Incineration Plant due to safety reasons: Hospital Directors generally send all the hazardous waste to incineration, but also the dubious not hazardous waste, instead to sent it to dumping site. It is widely recognized that Rome Incineration Plant is one of the qualitatively and technologically most efficient plant: the whole Rome's hospitals refers to this plant, and also some other Italians cities.

The Centre Hospitalier in Roubaix, France

The capacity of the Centre Hospitalier in Roubaix is 2000 beds, with the production of 1 ton of waste (all types of waste) per bed annually. The composition of the waste in the hospital is as follows.

Hazardous medical waste - 15% (3% of which are anatomical parts and cytostatics, the rest is infectious waste), 85% is non-infection waste. This 85% is made up of special industrial waste 2%, ordinary industrial waste 3%, with the remaining 80% similar to household waste of which 45% is recyclable. Before 1993, the hospital in Roubaix incinerated its waste without much segregation in an on-site incinerator. In 1993, it was decided to shut down the incinerator, and look for other disposal

methods. It was decided to pre-sort waste at the source and to treat its infectious part using a non-incineration method based on hot steam. In August 1993, the hospital bought Ecodas T1000 (a shredding-steam treatment-drying technology), and in 1995 another T1000 unit.

According to the hospital, Ecodas units were chosen because it decontaminates infectious waste using a steam-based process at 138°C, and the internal shredder reduces the initial volume of waste by 80%. Collection and sorting waste at source was adopted in order to avoid professional risks for staff at the hospital and for workers that collect waste. This also reduces transport costs.

The cost effective objectives have been met. The annual global cost of waste management at the hospital has been reduced by 30%.

The Netherlands - Zavin Plant

In the Netherlands, 8000 ton/year medical wastes are produced. Non-specific wastes from hospitals are treated as municipal waste. The total amount is relatively utile for a waste incineration plant, therefore one centralised plant (Zavin) has been realised.. It is located at the same site as the municipal waste incineration plant and a sewage sludge incineration plant. Zavin is an independent company, but co-operates in various technique and operational aspects with its neighbours. This causes some compensation for its relativity sail economy of scale.

The applied incinerator technique of the Zavin-plant is two stage pyrolysis incinerations. Rotary kiln incineration can be considered as an alternative technique. The specific clinical waste is collected regularly from hospitals and other healthcare institutes, including doctors, dentists and veterinary. The waste is collected in special 30 or 60 litre bins, which have been filled at the institutions and do not need to be reopened. The waste is then incinerated, including the bins, which also act as an auxiliary fuel. Only specific clinical waste is collected and treated in this way. The non-specific waste from hospitals and healthcare institutions is collected and treated as normal municipal waste. The collected waste is stored on site in closed transport containers. Bins are collected and transported semi-automatically to the incineration unit, which is located in a closed building. Feeding the incinerator occurs through an air lock, in order to prevent the introduction of false incineration air. Incineration takes place in a 2-stage process. In the lower incineration room, a controlled pyrolysis occurs, followed by incineration with primary air as the waste progresses through the room. Finally, the waste ends in a water-filed ash-discharger, from which the ash is removed by a chain conveyer system. The formed flue gases are incinerated with secondary air and, if required, with auxiliary fuel at a temperature level of approximately 1000 °C. Subsequently, they are cooled in a saturated steam boiler (steam temperature 225 °C, pressure 10 bar), a heat exchanger, and a scrubber. Steam is supplied to the adjacent municipal waste incineration plant, which uses the steam for various purposes and returns the related boiler feed water to Zavìn. The scrubber is a two-stage system for removing acid compounds. The treated flue gas is heated up (in the previously mentioned heat-exchanger and in a steam-flue gas heat exchanger) before passing a dust bag filter with adsorbents injection (activated carbon and lime), for removal of PCDD/PCDF and a SCR-DeNOx-unit. Emission concentrations of the emitted flue gases are analysed according to Dutch standards. The flue gases emitted through a 55-meter high stack.

The configuration of BAT adopted in Zavin plant allow to reach PCDD/PCDF emissions < 0.01 ng TEQ/Nm^3.

Low Cost Incinerators

High-temperature incinerators of simple design are currently being developed, and a system designed specifically for health-care and pharmaceutical waste in developing countries is currently under test at Montfort University, UK (Professor D.J. Picken innovative technology group Montfort University, UK).

Mobile incinerators provide an interesting alternative for hospitals both for thermal and for chemical waste treatment. They have been tested in Brazil. These units permit on-site treatment in hospitals and

clinics, thus avoiding the need to transport infectious waste. It may be a particularly interesting solution mainly for smaller hospitals because there is no need for them to operate the system themselves and because they are not responsible for the proper function of the system. The main problems for hospitals are operational system breakdowns resulting in extended downtimes. An additional problem is that the storage capacities for medical waste can be very limited, and local regulations could demand the rapid removal of the waste. Test results for units with a capacity of 30 kg/hour were satisfactory in terms of function, performance, and air pollution. (Bartone C (1998). Municipal solid waste management, Washington, DC, World Bank (report no. 16635).

Plasma Technology

A plasma demonstration plant is in Italy, at the CSM - Centro Sviluppo Materiali (Centre for material development) near Rome, where many experiments on different kind of waste (oil containing PCBs, ashes with high concentration of heavy metals, chlorinated plastics, asbestos, sludges, RDFs) have been carried out. 500 kw transferred arc torches are used in the plant, with a capacity of 250 kg/hour. High temperatures assure an extremely high efficiency in the destruction of wastes and organic compounds, with absence of PCDD/PCDF.

NORTH AMERICA

In North America, the attention on a separate category of medical waste within the municipal waste raised up from 1970s, when some wastes including syringes and bandages appeared on US East coast beaches. Although, the attention for waste minimization was a policy specifically mandated by the U.S. Congress in the 1984 with the Hazardous and Solid wastes Amendments to the Resource Conservation and Recovery Act (RCRA), however, the public concern led to the formulation of the US Clinical Waste Tracking Act (MWTA), which came into force in 1988.

Nowadays, Environmental Protection Agency (EPA) no longer plays a central role in medical waste regulation and the majority of medical waste generated in the U.S. is regulated at the state and local level. State regulations generally cover potentially infectious medical waste, sometimes referred to as regulated medical waste. There are several categories of medical waste, however, that are governed by federal regulations. Most states have regulations covering packaging, storage, and transportation of medical waste. Some states require healthcare facilities to register and/or obtain a permit. State rules may also cover the development of contingency plans, on-site treatment, training, waste tracking, record keeping and reporting. Furthermore, EPA has regulations governing emissions from Hospital/Medical/Infectious Waste Incinerators, as well as requirements under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) for medical waste treatment technologies, which uses chemicals for treating the waste. Finally, OSHA, the U.S. Department of Labor Occupational Safety & Health Administration, regulates several aspects of medical waste, including the management of sharps, requirements for containers that hold or store medical waste, labeling of medical waste bags/containers and employee training. These standards are designed to protect healthcare workers from the risk of exposure to pathogens.

In the United States, medical wastes are differentiated in three major categories:

A. Medical waste - all wastes generated from a facility (including offices, construction wastes and dining)

B. Medical Waste (a subset of medical waste) - waste generated as a result of patient diagnosis, treatment, or immunization of human beings or animals

C. Potentially Infectious Waste (a subset of medical waste) - that portion of medical waste that has the potential to transmit an infectious disease.

It is category "C" that a medical waste management scheme must be addressed first. The American Hospital Association indicates that this category of waste should not be more than 15% of the total

medical waste stream and a number of U.S. hospitals, which have implemented good segregation programs have reduced this portion of their waste stream to less than 8%.

By the technical point of view, the first solutions adopted to solve the problem of medical waste disposal was the installation of 6500 on-site, small and unregulated medical waste incinerators in healthcare facilities, but it was soon clear that these kind of small burners created more problems than expected, due to poor operation, emission of toxic pollutants and generation of other kind of waste. In 1994, when PCDD/PCDF were recognised as the main toxic emission from incineration process, the U.S. EPA led the first PCDD/PCDF assessment and identified medical waste incineration as the single largest source (over 60%) of PCDD/PCDF air pollution in the USA. Analogously, according to EPA reports in 1997 and 1999, medical waste incinerators were recognized as responsible for as much as 10% of all Mercury releases in air and more than 5% of Mercury releases in wastewater.

In 2000 and 2001, the USEPA and CCME (Canadian Council of Ministers of the Environment) promulgated regulations for existing and new incinerators, setting new emission limits for PCDD/PCDF. Existing incinerators had to be equipped with additional air pollution control devices to comply with the new legislation requirements. For the vast majority of hospitals and other operators of medical waste incinerator, however, investing in efficient filters was too expensive and resulted in the closure of more than six thousands plants. In 1988, for example, the number of facilities in the USA was estimated at 6200; by 2003, the number dropped dramatically to 115 medical waste incinerators nationwide. To overcome the situation, the American market opened to the introduction of non-combustion technology that up to now represents an important part of the methods used for medical wastes disposal, along with incineration, which continues to be the most common final solution.

Canada is party to a number of domestic and international agreements and programs to reduce mercury contamination in the environment. Mercury is a regulated toxic substance under the Canadian Environmental Protection Act, 1999. Estimates show that 30% of Mercury emissions to the air in 1995 were due to medical waste incinerators and that more than one-third of the Mercury load in sewage systems was due to dental practice. The Environment Canada's fact sheet Pollution Prevention in the Health Care Sector is the main document for the sector.

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CASE STUDIES IN NORTH AMERICA

Mercury Reduction in Ontario Hospitals

Environment Canada conducted in the last years a survey of mercury reduction initiatives at Ontario hospitals.

The results of the survey have been compiled from 93 of the 188 hospitals contacted in Ontario and showed that approximately 70% of the hospitals put a formal reduction program in place and that the average program length was 6.4 years. Another 9% had no formal program, but nonetheless reduced the amount of mercury in use.

Survey results also showed that 31% of the hospitals reduced the amount of mercury in products and devices by 1 to 50%, and over half had higher reduction.

Over 80% of the hospitals indicated that they use mercury spill kits for clean-up, while 35% also stated that they use protective equipment such as eye protection, body suits and closed shoes. Approximately 30% also indicated they use mercury disposal containers to prevent contamination of other wastes. A small number of facilities have invested in mercury vacuums to handle spills.

It was clear that Environmental Management Systems (EMS) could be used at healthcare facilities to manage handling, use and disposal of mercury and products that contain mercury. Over half of the hospitals responding to the survey established and implemented an EMS, while 45 % also put in place an evaluation system to monitor the EMS effectiveness.

Survey results indicated that less than 10% of the hospitals completed pollution prevention and/or EMS training. Pollution prevention trainings were provided to the healthcare sector by the Canadian Centre for Pollution Prevention.

The Bronson Methodist Hospital, Michigan, USA

The Bronson Methodist Hospital received in 2002 the Award Winner from the Association Hospitals for Healthy Environment. Bronson Methodist Hospital set up a waste minimization/energy conservation program that was run through every department of the hospital, including Contract Management, Materials Utilization, Materials, Property Management, Environmental Services, Facilities and Food Services.

In 2003, the hospital reduced the regulated medical wastes from 195,000 lbs to 192,000 lbs even with an increase in patient days of 5,608 (467 patients per month) and solid waste increase of 8%.

The hospital carried out the following actions

- Set up an environmentally preferable purchasing policy of buying items with a recycled content.
- The purchase of latex and PVC items, items containing mercury unless there is no alternative and marks items that contain recycled ingredients were prohibited.
- The hospital opened a Company Store, which was used to store excess office supplies and unused office furniture. This practice reduced the amount of solid waste disposed.
- Surgery started a program to reevaluate the use of disposable custom packs in 2004.
- An alcohol recycling system to both cytology and histology departments was introduced in order to reduce the amount of alcohol decanted into the sewer system, the amount of alcohol kept on site and the amount of alcohol purchased annually
- By using less toxic cleaning supplies, Bronson Hospital avoided contamination of the water supply and an increased concentration of mercury in the upper part of the food chain. Bronson reduced the release of persistent bioaccumulative toxins.
- Bronson hospital closed down its medical waste incinerator in 1996, thus reducing the amount of PCDD/PCDF released into the air.
- In 2003-2004 Bronson contracted a medical waste vendor to reduce the release of PCDD/PCDFs by using a combination of microwave and steam sterilization. Only trace chemotherapy and pathological waste is incinerated.
- In 2003-2004, Bronson contracted the Retired Engineer Technical Assistance Program (RETAP) to assess a waste and energy management program for the hospital with the target to conserve energy.
- Bronson established a mercury elimination program in June 1996 and in May 1999 signed a pledge with the National Wildlife Federation to go Mercury Free. Bronson's mercury management policy includes protocols for safe handling, mercury spill clean up procedure, disposal procedure-

recycling or regulated safe disposal to avoid disposal in waste stream mercury and its effects on human health and the environment. Bronson hospital even held a mercury thermometer exchange at a public health fair, in September 1999, giving out digital thermometers to the public. Additionally, Bronson replaced all of its sphygmomanometers and all known mercury containing stains or preservatives used in histology/pathology with standard zinc formalin ones.

- Bronson worked with Sterimed to reprocess single use devices, starting with SDC Sleeves in 2002.

Toxicity Reduction

Bronson Hospital's Regulated Medical Waste Reductions were reduced from 9% of total waste stream in 2001 to 6% of total waste stream in 2002 in spite of a significant growth in both inpatient and outpatient services.

Health Benefits

- By using mercury free alternatives, Bronson Hospital helped reduce the mercury exposure to patients and staff.
- Bronson Hospital reduced the amount of waste in landfills by switching to reusable dinnerware and donating medical supplies to a mission. This reduced the amount of chemicals that could leach into ground water or surface waters that may be used for drinking or bathing. This also diminished the amount of greenhouse gas emissions.
- By closing down it's incinerator, Bronson Hospital ensured a reduced risk of exposure to PCDD/PCDF.
- By ending the purchasing of PVC items, Bronson reduced the risk of exposure to phthalates present in PVC devices.
- By switching to less toxic cleaning supplies, Bronson helps reduce poor indoor air quality for patients and staff as well as reducing or even eliminating the exposure to chemicals.

JAPAN

In Japan, the disposal of medical waste is regulated by the Waste Management and Public Cleansing Law, which consider infectious waste as waste requiring special control and stipulates that hospitals, clinics and other medical institutions are responsible for the management of their medical waste. For this reason many hospitals and clinics contract private companies in order to respect the directives.

Medical waste management fees in Japan greatly vary depending on contractors. Some contractors charge 50 to 60 yen per kilogram or 400-500 US$/ton. Some semi-governmental waste management companies charge 350 yen ($3) per kilogram or US$ 3000/ton. It could occur that some contractors for economic reasons illegally dump medical waste, therefore the Waste Management and Public Cleansing Law was amended in 2000 with the aim to strongly enforce the responsibility of waste generators including hospitals to manage waste.

From data in 2000, the medical waste generation amount in Japan could be assumed as 150,000 tons, and the most popular method of treating the waste was and currently is incineration.

The types of incinerators are very wide. Capacity ranges from 0.08 to over 200 ton/day, although the majority of incinerators have a capacity of less than 5 ton/day. The law requires operators of any facility with a capacity of 200 kg/hr or more to obtain a construction permit.

INDIA

India is presented as an example of developing country where medical waste management has been set

up in an extensive and regulated way.

In India, regulations to control and manage air and water related pollution started in 1974 and 1981 when the Water Act and Air Acts were introduced in the country. The concern and need to manage the hazardous waste was felt only after the occurrence of the Bhopal gas tragedy in December 1984. The Ministry of Environment and Forests (MOEF) enacted the Environment Protection Act in 1986 and in 1989 the Hazardous Wastes (Management and Handling). In 1993, an updated inventory for hazardous waste in the country was initiated by the CPCB (Central Pollution Control Board). Rules in order to prevent indiscriminate disposal of hazardous waste, and efforts to generate inventories of hazardous waste generation were initiated. In spite of the rapid industrialization and the increasing amounts of hazardous wastes every year the response towards the implementation of such mitigation rules remained very poor. Medical waste was considered a part of the municipal waste till the problems associated with this kind of waste were realized. There was no legislation on this issue till the MOEF proposed the first draft rules in 1995, which recommended the use of on-site incinerators for all hospitals with more than 50 beds. In March 1996 in a public interest case, the Supreme Court of India ordered the inclusion of alternative technologies and their standards in the Rules. Finally, in 1998 Bio-medical Waste (Handling and Management) Rules were promulgated for waste management in hospitals. According to the Rules, it is the duty of who generate the waste, to set up medical waste treatment facilities like incinerator, autoclave, microwave for treatment of waste, or ensure that the waste be treated at a common waste treatment facility. Medical waste has to be segregated at the point of generation before its storage, transportation, treatment and disposal and containers are to be labeled. No untreated waste can be kept beyond a period of 48 hours.

Two other amendments were set for the introduction of some waste management facilities for treatment of waste and for defining the role of the municipal body of the particular area, nominating Pollution Control Boards/ Committees as Prescribed Authorities for granting authorization and implementing the rules.

A WHO study on medical waste has estimated that in India of the total waste generated in health care facilities about 85% is non-infectious, 10% infectious but non-hazardous and 5% hazardous (CPCB 2000). In spite of this strict regulation and legislative efforts, some evaluation carried out by various agencies in the last years showed that the health care establishments in India have given low attention to their waste management and the process of waste segregation, collection, treatment and disposal , although many of the larger hospitals have installed the treatment facilities. In addition, a large part of medical waste generated from health care facilities were and are currently disposed of with municipal waste in dumping sites. Most of the medical waste is collected without segregation into infectious and non- infectious categories and disposed of in municipal bins located either inside or outside the facilities. This waste is collected with other MSW and transported to municipal dumpsites, sometimes not properly managed, therefore leading to a high risk of general infection or injury due to sharps objects.

In order to enforce the legislative effort with practical actions, the Government of India initiated some activities to set up the hazardous waste management with proper waste segregation and minimization procedures, and adoption of cleaner technologies. Some hazardous waste inventories started in various states to gather updated information, in order to identify sources of hazardous wastes methods for recycling and disposal sites. Training programs have been organized for the personnel of the main important health care facilities so as to familiarize them with precautionary measures and waste management inside hospitals.

Although incineration of medical waste is widely used, alternative methods of treating the wastes are being given consideration in the last years. Incinerators at an individual hospital or facility are discouraged, and the incineration of chlorinated plastics is prohibited. Moreover, India has an NGO network specifically dedicated to work on medical wastes, and with initiatives in several cities. India is presently preparing a POPs National Implementation Plan with support from UNIDO.

Annex 2: FEE-BASED MEDICAL WASTE SYSTEM

According to national regulations on medical waste management, medical waste treatment facilities are permitted to charge hospitals for treatment of medical waste, and hospitals are permitted to pass on those costs to patients. However, national regulations do not specify the basis for these fees, or how they should be collected. As a result, different approaches have been adopted, including principally:

- Flat fee based on number of hospital beds
- Charge based on actual medical waste treated, by weight

Ideally, fee-based systems can significantly improve the efficiency and effectiveness of medical waste management system operation, as well as providing incentives to stakeholders to minimize waste. However, given the haste with which these systems have been implemented, little attention has been paid to maximizing efficiency and minimizing waste. In many cases, systems adopted may in fact reduce efficiency and provide no incentive for waste minimization. In addition to system design issues, fee systems may also be incompletely implemented and/or poorly managed, resulting in further inefficiencies, disincentives and negative financial impacts to stakeholders. In addition, only the medical waste processor currently receives revenues from the fee-based system, with no funds retained by hospitals to cover their own waste management costs.

Flat fee system

A flat fee system based on number of hospital beds has the advantage of simplicity. Several potential variants of this system exist. One variant charge on the basis of total hospital beds, which is a known figure, is easily verifiable, and does not generally vary. Alternatively, a flat fee could be charged on the basis of beds occupied. The latter approach would more effectively track waste generated, but at a greater administrative burden to the hospital, and lesser ability for the medical waste treatment facility to verify those figures.

The flat fee-based system based on number of hospital beds has several major drawbacks: it provides no incentive for hospitals to minimize waste. This approach also involves a higher level of financial risk to the medical waste treatment facility, since revenues received may not coincide with the treatment costs.

Weight-based system

In many cases, a weight-based fee system has been adopted. The medical waste treatment facilities hauls away and treats the hospital's waste, and then charge the hospital based on the weight of the waste treated.

This approach has the advantage of giving the hospital an incentive to reduce medical waste amount, and will generally track actual treatment costs better than a bed-based approach. Weight-based fees are also more easily verifiable, since both the hospital and treatment facility can track waste weight. However, a strictly weight-based approach has two drawbacks:

- It does not consider physical waste volume, which is an more important determinant of total waste treatment cost, since waste transportation is often the largest cost factor and transport costs are based on physical volume rather than weight; and
- When waste volumes vary significantly, unit-based fees do not reflect total treatment costs, given that total treatment costs have both fixed and variable cost components. While the variable cost can easily be incorporated into a unit charge, allocation of fixed costs requires an estimate of total annual volume. If actual volume differs significantly from physical volume, unit costs will then vary significantly, and the unit charge will either over or under-state costs.

It has been proposed that the weight-based waste treatment fee be flowed through by the hospital to the patient via a surcharge to the patient for supplies based on the waste treatment cost (or even

PCDD/PCDF content) inherent in those supplies (i.e., items that required treatment would carry the charge proportional to that cost, and items that don't require treatment would carry no charge). While this approach appears efficient and equitable at first glance, it actually is not, suffering from several drawbacks:

- The administrative cost of calculating, tracking, and charging for medical supplies based on their inherent treatment cost would be significant;
- This approach would shift the cost burden of medical waste treatment to the patient, who is not in a position to minimize medical waste creation (unless he/she refuses treatment, which would is not a practical or ethical decision to confront the patient with) or to procure less waste or PCDD/PCDF-intensive supplies. Given that this ability lies with the hospital alone, the incentive to reduce waste should therefore remain with the hospital.

Accordingly, while the weight-based fee is more efficient and equitable than the bed-based fee for payments from the hospital to the medical waste treatment facility, the reverse is true for payment from the patient to the hospital.

Why the current fee-based system does not work

The regulations establishing the current medical waste fee system are in the form of guidance documents, and are not mandatory. This lack of mandatory enforcement and the regulations' vagueness regarding approaches has inhibited development of consistent and optimal systems. Because of the lack of specific guidance and requirements, the decision on which fee approach to adopt is often made by the local price setting bureau based on factors not related to the ultimate efficiency and sustainability of the system. The local price setting bureau may itself be ideologically opposed to fee collection, given the backlash China is currently experiencing to the prevalence of questionable local fees. In addition, widespread social discontent with high medical treatment costs in creates a public perception that hospitals always overcharge patients, and that medical waste disposal costs should be borne by the hospital directly rather passed on to patients.

An additional factor contributing to disfunctionality in the current approach is the difficulty of coordination among various local stakeholders in determining fee levels. Conflicting interests among health departments (hospitals), the local EPB (waste disposal), the local Price Setting Bureau, the Department for Industry and Business, and other stakeholders make it difficult to arrive at an efficient outcome.

Alternative approaches

A variety of alternative approaches for fee-based medical waste systems exists, the simplest among which would be an annual or monthly fixed amount, which could be periodically renegotiated. While this approach would provide stable revenue to the treatment facility, it has the drawback of not providing incentives for waste minimization, and of negative financial impact on either the hospital or treatment facility depending on whether the fee is set above or below actual treatment costs, i.e., greater risk of a win-lose situation.

A combined fee approach represents a potentially superior option, as the combined fee can be structured so as to track both fixed and variable treatment costs. Since fixed costs relate principally to treatment capacity, these can be allocated to hospitals on the basis of either maximum projected waste volume (i.e., the maximum amount of waste which they produce per day, week, or month, or "load"), or on the basis of a proxy variable that tends to track maximum waste volume, such as number of beds (or number of beds occupied). Variable costs are then charged on the basis of actual weight (or physical volume, expressed in number of bags, bins, or trucks worth of waste). This combined

approach has the benefit of providing a strong incentive to hospitals to minimize waste in order to reduce both variable and load charges. This approach also provides a stable revenue base to the treatment facility that most closely covers its actual treatment costs, allowing for sustainable and lower risk funding of treatment facilities.

Revenue allocation

In order to provide sustainable funding for internal hospital activities to manage and minimize medical waste, the project will promote a revenue allocation approach that retains a portion of the funds collected by hospitals from patients in order to finance the hospital's internal costs, rather than passing the entire fee through the hospital to the waste treatment facility as is commonly the case now. The total amount charged to patients and proportions retained and transferred to the treatment facility should be determined based on actual system costs.

Project approach

In order to maximize efficiency, equity and sustainable funding, the project will therefore undertake to train officials and hospital staff in alternative fee systems and their benefits, and will work with them to promote approaches, as described above, that are both efficient, equitable, and provide strong incentives to minimize waste generation, reduce overall treatment costs, reduce PCDD/PCDF intensity in the resulting waste generated, and develop and implement systems to efficiently and effectively administer the fee program.

ANNEX 3: IDENTIFICATION AND RESPONSIBILITIES OF STAKEHOLDERS

National Development and Reform Commission (NDRC): As a department under the State Council for macro control of national economic operation, the NDRC is responsible for advancing the sustainable development strategy, carrying forward adjustments on strategic as well as upgrading of the industrial structure and providing guidance on national industrial development policies. It plays a significant role in the comprehensive planning of the construction of dedicated disposal facilities for MW. Pursuant to the arrangement by the State Council, the NDRC and SEP A jointly formulated the NPHMW, which is an important measure to implement the Regulations on Management of MW and ensure the realization of the goal of safe disposal of MW.

Ministry of Finance (MOF): The MOF assumes the responsibility for foreign negotiation and consultation with regard to loans from foreign governments, the World Bank, Asian Development Bank (ADB) and banks of developed countries and joint international financial organizations on behalf of the Chinese government; supervises the implementation of guidelines, policies, laws and regulations on finance and taxation; examines and reflect material problems in government revenue and expenditure management; and propose policy suggestions on strengthening the financial administration.

Ministry of Science and Technology (MOST): The MOST is responsible for studying major issues on science and technology promoting economic and social development; studying and deciding on key arrangements and priorities for scientific and technological development; promoting construction of the national scientific and technological innovation system and improving national capacity for scientific and technological innovation. Some topics relating to MW have been listed into the national program for scientific and technological development. With the implementation of this project, the Ministry will be consulted to include new topics of needs in the national program for scientific and technological development.

General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ): The General AQSIQ is a department directly under the State Council in charge of national work on quality, metrology, entry-exit commodity inspection, entry-exit health quarantine, certification and accreditation, standardization, etc. It can formulate standards and rules for accreditation to relevant agencies and for certification of MW treatment equipment.

State Environmental Protection Administration (SEPA) The State Environmental Protection Administration is responsible for the regulation of environmental pollution from MW management and disposal. Its primary duties for MW management are as follows:

- Organize drafting and formulation of rules and regulations related to safe disposal of hazardous wastes (including MW) and review technical standards on safety of hazardous wastes;
- Organize supervision and assessment of the safety performance of hazardous waste disposal facilities, and issue or revoke operation licenses of hazardous waste disposal facilities;
- Undertake the responsibility to investigate and solve safety accidents on hazardous wastes;
- Guide and supervise the formulation and implementation of contingency plans for hazardous waste disposal facilities, in coordination with related departments;
- Organize departments concerned to carry out scientific research, publicity and education, and liaison of international organizations with regard to safety and management of hazardous waste ; and
- Organize departments concerned to carry out assessment of hazardous waste disposal technology and related technical trainings in dedicated disposal facilities.

Ministry of Health (MOH): Jointly with SEPA, the MOH formulates and issues the catalogue of classified MW, and formulates the standards for special packages, containers of MW, and labeling. The MOH implements supervision over the MW management of medical and healthcare institutions at national level and guides health administrative departments of the people's governments at the county

level and above to carry out supervision over the MW management of medical and healthcare institutions within their respective jurisdictions.

Research Institute of Hospital Management (RIHM) is authorized by the MOH to conduct scientific research on hospital management, train managerial and medical personnel for hospitals, collect and analyze information from international and domestic sources regarding hospital management and provide technical support to the governments and relevant agencies in formulating policy and making decisions. Scientific research, policy-making and relevant trainings on medical waste management in medical institutions are one of its important responsibilities designated by MOH.

Local Environmental Protection Bureaus (EPB) at the county level and above: The local EPBs conduct unified supervision and management on the environmental pollution prevention and control in collection, transport, storage and disposal of MW; and in the event of any environmental pollution accidents resulting from mismanagement of MW, or in the event that there is evidence that such accidents are likely to occur, take provisional control measures, evacuate people, control the accident site, and order to stop operations leading to or likely to lead to such environmental pollution accidents.

Local health bureaus at the county level and above: Conduct unified supervision and management on the work of disease prevention and control in collection, transport, storage and disposal of MW, and exchange on a periodic basis results of supervision and inspection or spot check with local EPBs; and in the event of any infectious disease spreading resulting from mismanagement of MW, or in the event that there is evidence that such accidents are likely to occur, take provisional control measures, evacuate people, control the accident site, and order to stop operations leading to or likely to lead to such infectious disease spreading.

Pricing Bureaus: Pricing Bureaus assisted by health departments and environmental protection departments determine and promulgate levy standards for the treatment of MW, and coordinate operation enterprises and MIs in reaching the agreements for the collection and transfer of the levy for MW treatment and disposal.

Other government functional departments: Land planning departments make the planning of land used for MW disposal facility construction. Departments in charge of urban construction are responsible for the construction and management of municipal landfills, which receive treated MW residues. Departments for industry and commerce examine and approve business licenses for MW disposal units.

Technical support institutions: The technical support units under the direction or designation of SEPA and MOH and the scientific research institutes in the academic community undertake technological development for MW management and disposal, introduce and assess advanced technology, carry out environmental impact assessment on facility construction, provide technical trainings, and make recommendations for improvement and revision of related policies, laws, regulations and standards.

Medical and health institutions, have duties stipulated under the Regulations on MW Management (State Council Order No.380, [2003]) as follows:

- Establish and improve the responsibility system for MW management, in which the legal representative assumes the foremost responsibility, and substantially fulfills duties to prevent infectious disease spreading and environmental pollution accidents arising from MW.
- Formulate rules and regulations related to safe disposal of MW, as well as emergency response plans; and set up a monitoring department or full-time/part-time person responsible for inspection, supervision and implementation of MW management system.
- Carry out trainings of technical and managerial personnel engaged in collection, transport, storage and disposal of MW with regard to such knowledge as relevant laws, regulations, expertise, safety protection and emergency response.
- Take effective measures on occupational health protection, equip technical and managerial personnel engaged in collection, transport, storage and disposal of MW with necessary protective appliances,

and carry out health examination on a regular basis; where necessary, vaccinate personnel to protect them from health damage.

- Implement the manifest management system on transfer of hazardous waste in accordance with the provisions of the Chinese Law of the People's Republic of China on the Prevention and Control of Environmental Pollution Caused by Solid Wastes.
- Register MW with regard to, among other items, the source, type, weight or quantity, handover time, disposal method and final destination of MW as well as handler's signature, and keep records for at least 3 years.
- Take effective measures to prevent release, leakage and loss of MW. In the event of release, leakage or loss of MW, take emergency response measures to reduce damage, and provide afflicted persons with medical aids and on-site rescue, while reporting to the administrative departments in charge of health and environmental protection under the people's government at the county level and keeping informed units and residents likely to be harmed.
- Establish facilities and equipment for temporary storage of MW and store MW pursuant to relevant provisions and requirements; employ leakage proofed and puncture resistant equipment and tools to gather and transport MW to the temporary storage site according to the internally determined time and route of transport.
- Hand over in time MW to the transporters of MW disposal units for disposal. High-risk waste among MW such as culture medium of pathogen, specimen, and bacterium and toxin preservation solution, should be disinfected in advance by MIs before handing over.
- The sewage produced and excreta of infectious patients or suspected infectious patients should be disinfected strictly in accordance with relevant regulations before being discharged into the drainage system of MI.
- In rural areas without conditions for centralized disposal of MW, medical and health institutions should dispose of MW they produce in accordance with the requirements of the administrative departments in charge of health and environmental protection under the people's governments at the county level.

Dedicated MW disposal units have the same duties with those of MIs from Item (1) to (7) as presented above, as well as differentiated duties stipulated under the Regulations on MW Management (State Council Order No.380, [2003]) as follows:

- Apply to the local EPBs for the license of dedicated MW disposal operation; any units without obtaining the license for operation shall not be permitted to operate dedicated MW disposal facility.
- Collect from medical and health institutions and transport MW at least once in 2 days, and undertake the responsibility for the storage and disposal of MW.
- Transport MW in accordance with regulations related to transportation management on hazardous goods, employing special vehicles with clear MW labels. Such special vehicles should be disinfected and cleaned in time within the MW disposal facilities. In transporting MW, safety should be assured and MW should not be discarded or dropped.
- Install online monitoring devices for monitoring the emission of pollutants and ensure that such devices are in normal working condition.
- Carry out periodic testing and assessment of the environmental pollution prevention and control and hygienic effects of MW disposal facilities pursuant to provisions of administrative departments in charge of environmental pollution and health. The testing and assessment results should be archived by the MW disposal facilities and reported to the local administrative departments in charge of environmental protection and health biannually.

Non-governmental organizations (NGOs): NGOs are established within the scope of national laws, policies and regulations in China. Typically dependent on a governmental department or focusing on a sector, a non-governmental organization specializes in information collection and dissemination,

public and stakeholder awareness raising, and promoting the implementation of best environmental practices among enterprises. At present, important NGOs related with health care management in China include MW Management Committee under the China Association of Environmental Protection Industry and China Management Committee for Medical Devices sponsored jointly by the MOH and SEPA.

In general, all the aforementioned institutions have important and indispensable roles to play in realizing the life-cycle management of MW. In reality, their capacities for MW management are generally low and are at an early stage of development due to the very short time since China has formally started to regulate MW management. There is also a great disparity of capacity among different institutions. Therefore, top priorities should be given to institutional strengthening.

ANNEX 4: TERMS OF REFERENCES

1. Post: Chief Technical Advisor

The objectives of this assignment are to:

i. Transfer international experience in the lifecycle management of medical waste through NTA and other local experts to the managerial and technical and medical staff in medical institutions and dedicated medical waste disposal facilities. Provide technical advice for the reduction of PCDD/PCDF emission from medical waste disposal, including training manual, training program, alternative techniques, monitoring and evaluation;

ii. Assist CIO in overall technical support of other project activities, including institutional strengthening, policy development, replacement of redundant incineration equipment, alternative technique application, monitoring and evaluation, and inspection for enforcement and compliance;

iii. Review TORs for individual experts and implementation of project activities;

iv. Monitor the progresses against milestones and indicators set for the project implementation, and formulate reports for workshops of Technical coordination.

v. Advise CIO on project monitoring, evaluation, including providing comments and finalizing the English version of semi-annual progress reports on the ongoing activities, and annual action plan;

vi. Troubleshoot technical and implementation issues that may emerge.

SCOPE OF WORK

The Chief Technical Advisor (CTA) will assist CIO, together with national experts, to oversee all technical components of the Project. The Grant Agreement, Project Appraisal Document, the Project Implementation Manual and the Annual Work Plan are the basic documents describing the project and guiding its implementation. Through continuous project monitoring, the CTA will assist CIO to provide corrective countermeasures for accidental problem. The CTA will work together with the National Technical Advisor and a number of other individual technical experts at the highest technical level. The CTA will report directly to the Project Manager in the SEPA CIO.

1. The CTA will provide overall technical assistance in the following aspects:
    a. Support to workshops and trainings: including participating in all important project workshops, introducing relevant international experience in the workshops, and reviewing and commenting all relevant deliverables of the workshops. This will include the following workshops:
        i. inception workshops (national and regional inception workshops)
        ii. alternative technologies and techniques evaluation workshop
        iii. policy and regulatory framework reform workshop
        iv. 2 monitoring and evaluation workshops
        v. 4 annual project implementation review meetings
        vi. the technical consultation and institutional coordination workshops
        vii. the alternative equipment marketing workshop
        viii. the project results publicity and dissemination workshop
        i. Technical coordination workshops among stakeholders of the project

b. Support to PCDD/PCDF reduction implementation including:

ii. developing a work plan of PCDD/PCDF reduction implementation

iii. providing assistance in developing R&D competition and incentive program.

iv. reviewing and finalization of the alternative operating and training manual and training programs,

v. participating in the training for researchers and trainers to transfer of the alternative technologies to domestic equipment manufacturers and dedicated medical waste disposal facilities.

vi. drafting technical specifications of new equipment procurement.

vii. guiding with the equipment suppliers the local experts of enterprises on specific issues concerning equipment installation, operation, and monitoring.

c. Monitoring and Evaluation for the whole process of the project. At this level the CTA will

i. review and finalize the TORs for selection of experts and implementation of project activities in order to guarantee TORs are prepared in compliance with the requirement of the project and the principles of Stockholm Convention.

ii. review and finalize all key project reports as follows:

- Review draft of the 2nd, 3rd, 4th, and 5th annual work plan of the project,
- Review the quarterly progress reports on the ongoing activities.
- Review the evaluation report on national policy and regulation reform
- draft the framework of incineration and incineration and alternative technology R&D and acquisition.
- finalize the English version of all project reports and deliverables before dissemination to relevant stakeholders

d. Provide technical advice on establishment of MIS including:

i. parameters for PCDD/PCDF reduction monitoring.

ii. provide available international information on reduction of PCDD/PCDF emission from medical waste disposal to domestic technical and managerial staff.

e. provide corrective countermeasure for accidental issues and provide advice on miscellaneous project matters as requested by CIO.

QUALIFICATIONS:

i. Extensive practical experience with reduction of PCDD/PCDF emission from medical waste disposal implementation;

ii. extensive knowledge of international situation of incineration and alternative technologies, especially the new cost-effective ones;

iii. PhD in a field directly related to medical waste management and disposal;

iv. experience with implementation of international projects; and

v. good communication and writing skills in English;

The following qualifications will be helpful:

vi. knowledge of the Stockholm Convention on POPs;

vii. experience of working in China.

DURATION:

Fifteen working months over a period of five years of which at least 8 working months in China, splitting in regular missions. At least some missions will have to coincide with the UNIDO supervision missions. The number and duration of missions will be determined in the course of the project in accordance with the work plan. Additional time may be added to the contract if considered necessary by the CIO.

2. Post: National Technical Advisor

OBJECTIVES

The objectives of this assignment are to:

vii. Assist CIO in overall technical support of other project activities, including institutional strengthening, policy development, replacement of redundant incineration equipment, alternative technique application, monitoring and evaluation, and inspection for enforcement and compliance;

viii. Transfer international experience in the lifecycle management of medical waste from CTA and other local experts to the managerial and technical and medical staff in medical institutions and dedicated medical waste disposal facilities. Provide technical advice for the reduction of PCDD/PCDF emission from medical waste disposal, including training manual, training program, alternative techniques, monitoring and evaluation;

ix. Project monitoring and evaluation, including preparation of TORs for project activities and project reports, and providing solutions to the project critical tasks;

x. Monitor the progresses against milestones and indicators set for the project implementation, and formulate reports for workshops of Technical coordination.

xi. Help CIO with the preparation of technical aspects of workshops.

SCOPE OF WORK

NTA will assist CIO, working in a team with the CTA and other individual technical experts, in charge of all technical components of the Project. The Grant Agreement, Project Appraisal Document, the Project Implementation Manual and the Annual Action Plan are the basic documents to be referred to. Through continuous project monitoring, the NTA will assist CIO to provide corrective countermeasures for accidental issues. The NTA will be the leader of the National Experts Group for the project, and will collaborate with the CTA. The NTA will report directly to the CIO and UNIDO.

The NTA will provide overall technical assistance in the following aspects:

a) Support to workshops: including participating in all important project workshops, making presentations on project progress in the workshops, and preparing, reviewing and commenting all relevant deliverables of the workshops. The workshops are specified as:

- inception workshops (national and regional inception workshops)
- alternative technologies and techniques evaluation workshop
- policy and regulatory framework reform workshop
- 2 monitoring and evaluation workshops
- 4 annual project implementation review meetings
- the technical consultation and institutional coordination workshops
- the alternative equipment marketing workshop

- the project results publicity and dissemination workshop
- the technical coordination workshops

b) Support to PCDD/PCDF reduction implementation including:
- Draft the questionnaires for participants before large scale trainings on managerial, technical and medical staff
- review and commenting on the incineration and alternatives operating and training manual and training programs,
- Participation in the training for managers, researchers, trainers and operators to give a presentation on medical waste disposal technologies
- Making presentations to national and local medical waste management experts in the trainings.
- Assistance in preparing Request for Proposal (RFP) of alternatives raw materials and equipment procurement, including TOR, Letter of Invitation (LOI), draft contract.
- guiding the local experts and enterprise technical staff on specific issues concerning equipment installation, operation, and monitoring.
- Prepare annual evaluation report on PCDD/PCDF emission reduction implementation
- provide technical advice for the development of R&D competition and incentive program.

c) Monitoring and Evaluation for the whole process of the project. At this level the NTA will prepare, Review and finalize all reports include:
- Review the outputs related to reduction of PCDD/PCDF emission from medical waste disposal
- Review and give comments on 2nd, 3rd, 4th, and 5th annual work plans of the project
- Review and give comments on the semi-annual progress reports on the ongoing activities.
- Review the evaluation report on national and provincial policies and regulations submitted by consultant firm.
- Provide technical support and guidance for technology transfer from the R&D communities to enterprises with CTA;

d) Supervision of procurement, installation, and operation of demonstration facilities, the NTA will:
- assist CIO in the preparation of hiring of an independent supervisory company;
- assist CIO in the preparation of a monitoring plan;

e) Provide technical advice on establishment of MIS including:
- draft parameters for PCDD/PCDF emission reduction monitoring.
- Transfer the international information from CTA on advanced incineration and alternatives to the technical and managerial staff in the field

f) Besides above assistance, the NTA will also provide corrective countermeasure for accidental issues.

QUALIFICATIONS OF THE CONSULTANT

The consultant will have:

a. Extensive practical experience with reduction of PCDD/PCDF emission from medical waste disposal implementation;
b. extensive knowledge of international situation of incineration and alternative technologies, especially the new cost-effective ones;
c. excellent communication and writing skills in English and Chinese
d. experience with management and coordination of international cooperation projects
e. excellent interpersonal skills

The following qualifications will be helpful:

f. knowledge of the Stockholm Convention on POPs
g. experience of working on POPs related projects in China

DURATION:

30 working months over a period of five years including 9 months for the field visit to participating provinces. The number and duration of missions will be determined in the course of the project in accordance with the work plan.

3. Post: Project Team

1. To ensure the successful implementation of project, a medical waste project team within CIO/SEPA will be established. The team will be in charge of the daily operations and implementation of the Project under the guidance of the CIO, implementing activities assigned to CIO, supervision and monitoring of all activities implemented under the project, provide technical advice and support, financial management for all aspects of the project and reporting within SEPA and to UNIDO.
2. Initially, the team consists of one project team leader and three project officers (two project officers from SEPA and one seconded from the Ministry of Health). Additional officers may be added, such as from Ministry of Constructions. The medical waste project team will receive technical support from various experts (including CTA, NTA, and other consultants) as necessary. The existing CIO financial and procurement staff will provide financial and procurement management support to the project team.

Responsibilities

The medical waste project team's responsibilities are to:

a. prepare TORs for activities implemented by CIO and review TORs prepared by Local PMOs in three demonstration provinces;
b. prepare quarterly Financial Monitoring Reports (FMR) and review FMR submitted by Local PMOs;
c. manage project procurement and financial resources for activities managed by CIO with in accordance with the UNIDO's procedures and the agreed procurement plan;
d. organize and convene project coordination and review meetings among stakeholders;
e. review project outputs;
f. collect project and national data and information and input them into medical waste project MIS and prepare FMR to the UNIDO using MIS;
g. organize training, education, and information dissemination activities;

h. provide direction to local Local PMOs;

i. incorporate project quarterly financial reports from its component, and provincial components and submit withdrawal application to MOF for replenishment;

j. recruit international and national consultants in CIO-managed components;

k. provide direction to the Local PMOs for carrying activities in the coastal provinces;

l. prepare Annual Work Plan and Procurement Plan for the activities managed by CIO and review the Annual Work Plan and Procurement Plan submitted by Local PMOs;

m. Coordinate with stakeholders, including GEF, donors, the UNIDO, and relevant domestic ministries and agencies.

The key responsibility of the team leader and each of the existing three project officers are as follows.

Team Leader: report to the UNIDO

Key qualifications:

i) sufficient project management skill and experience;

ii) capacity in team management;

iii) familiarity with the project;

iv) familiarity with UNIDO procedures;

v) Excellent written and spoken ability of both Chinese and English.

Responsibilities:

a. overall management of the project implementation to ensure the quality and timeliness of project implementation;

b. communication with the UNIDO and donors concerning project implementation;

c. communication within SEPA, national agencies and local PMOs;

d. Organization of staff resources to ensure coordination and harmony of the team;

e. Monitoring the use of counterpart and GEF funds.

Project Officer 1: responsible for MIS, M&E, and NRP, report to the team leader, demonstration and adoption of BAT/BEP

Key qualifications:

i) project management experience;

ii) good knowledge on environmental monitoring and medical waste management in China;

iii) knowledge or experience of information management;

iv) knowledge on requirement of UNIDO and China on EIA;

v) good written and spoken ability of both Chinese and English.

Responsibilities:

a. communication with CTA and NTA, as well as review the outputs of CTA and NTA;

b. organize the bidding processes to select and acquire services and goods;

c. organize the trainings on managerial, technical and medical staff;

d. organize the bidding processes to set up the training system;

e. organize the implementation of EIAs supported with the newly developed guidelines and specifications for BAT/BEP adoption in the lifecycle management of medical waste;

f. monitor the procurement of manufacturers and implementation of the conversion;

g. organize M & E according to GEF's guidelines;

h. communication with the UNIDO and Local PMOs concerning above issues.

Project Officer 2 (Coordinator from MOA): responsible for Policy Framework for BEP application in medical institutions, BEP demonstrations, inspection and enforcement, focal point to the local PMOs, report to the team leader

Key qualifications:

i) project management experience;

ii) comprehensive knowledge about medical waste management and relevant policies;

iii) good written and spoken ability of both Chinese and English.

Responsibilities:

a. routine communication and coordination with MOH;

b. communication with alternative antifouling paint advisor recruited by CIO, review the advisor's outputs;

c. management of national policy and regulatory study;

d. review the output on provincial policies and implementation;

e. communication and coordination with provincial authorities concerning PCDD/PCDF reduction through improving incineration and adopting non-incineration techniques;

f. organize the implementation of public awareness improvement activities on alternatives;

g. organize the implementation of research and development;

h. review the FMR submitted by Local PMOs concerning above activities;

i. Communication with the UNIDO and Local PMOs concerning above issues.

Project Officer 3: responsible for general activities, report to the team leader

Key qualifications:

i) project management experience;

ii) experience in organization of workshops;

iii) comprehensive knowledge on procurement guideline of UNIDO;

iv) good written and spoken ability of both Chinese and English.

Responsibilities:

a. routine communication and coordination with Local PMOs;

b. organize the workshops and training managed by CIO;

c. organize procurement of the activities managed by CIO and monitor the procurement of the activities managed by Local PMOs;

d. responsible for the procedure on payment of contracts and assist Finance Division of FECO to draft the finance report of FMR;

e. updated the information in medical waste website and MIS;

f. draft the FMR concerning activities managed by CIO and consolidate the FMR;

g. update annual Work Plan related to the activities managed by CIO and consolidate the annual Work Plan submitted by Local PMOs;

h. update the procurement plan related to the activities managed by CIO and consolidate the procurement plan submitted by Local PMOs;

i. Routine communication with the UNIDO and Local PMOs concerning above issues.

ANNEX 5: BUSINESS PLAN

The business plan has been developed based on the Italian Government financed pilot BAT/BEP project under the framework of the Sino-Italian Environmental Program and executed by UNIDO. The pilot project has been carried out at two sites, in Huzhou Century Clean Solid Waste Treatment Centre and Jinan Hanyang Solid Waste Disposal Co., Ltd.

Process Optimization and Process Improvement Measures

As BAT/BEP measures the following process optimization and improvement measures have been carried out in the two plants

- A semi-continuous operation of the selected medical waste incineration plants with a slower feeding rate in order to reduce the start-ups and close-downs to avoid high levels of emissions;
- Addition of activated carbon injection devices before the bag filter or modification of the existing carbon injection device before semidry scrubber by injecting separately lime and activated carbon in order to improve the PCDD/F adsorption efficiency.
- In order to reduce the releases of acids and micropollutants from the semidry scrubber the number of injection nozzles for alkaline lime spraying was increased. The separate injection of activated carbon and lime could have a fire or explosion risk that has been solved by the optimisation of the operating temperature of the scrubbers;
- The optimization of alkaline addition has been carried out to reduce risky salt deposition on the tubes;
- The regular cleaning of the boilers and heat exchangers has been made;
- Since there has been no monitoring device of particulate matter and other macro-pollutants at the stacks, the installation of automated devices and increasing the frequency of manual samplings was suggested;

Additionally, the following measures have been carried out in Huzhou Century Clean Solid Waste Treatment Centre;

- A storage room for the residues and fly ash has been constructed in
- At the beginning of the project the glass content in the medical waste was over 27% and constitutes a large part of the bottom slag at the incinerator. The separation of glass from the slag was carried out manually. A mechanical separator devise has been installed improving efficiency and recycling the glass particles in bottom slag;
- To avoid mercury emission a new activated carbon injection procedure was applied;
- A techno-economic study with batch and continuous operation has been carried out to determine operational parameters, emission profiles, equipment depreciation and maintenance etc;
- Measurements have been carried out in routine existing and optimized work conditions (high temperature 1,100°C) to obtain comparative operational data and optimize the management system;
- The bags in the filter have been replaced by new higher quality bags to effectively remove fly ash. In the by-pass duct, a second airproof valve has been installed to prevent the flue gas leaking through by-pass duct; and
- During the combustion operation, some inhibitors such as coal of high sulphur content and $(NH_4)_2SO_4$ have been regularly added into the feeding waste to decrease the formation of PCDD/Fs.

Analytical sampling protocol

In order to adequately evaluate the performance of the implemented BAT/BEP in unintentionally produced PCDD/Fs reduction, in the two plants the sampling sites for gas sampling through the technological process closely related to the formation of POPs were determined as follows:

Raw and flue gas samplings

- Sampling site in front of semi-dry absorbers,
- Sampling site in front of bag filters.
- Sampling site in front the carbon tower

As far as the sampling before and after the scrubber is concerned, In Huzhou the injection of the activated carbon was stopped during the first sampling campaign. After the implementation of the new carbon injection device before the filter, the first one was put into operation again to be able to follow the emission reduction efficiency for both devices

Flue gas sampling at the stack
Some modification were adopted in the two plants

- In Huzhou stack sampling site was considered to close to the nearest obstruction (the tube from the scrubber that conveys flue gases into the stack). It was decided to move the sampling port 1.3 m above former sampling point.
- In Jinan the stack was completely rebuilt

Solid residues

Solid residues were collected during the sampling round under the same operation parameters as in the case of gas sampling (same feeding, same operational time) as follows:

- Slag and bottom ashes from fluidised bed and rotary kiln
- boiler bottom ashes
- filter fly ashes

Raw medical waste and the wastewater were also sampled and analysed.

The operational parameters recorded during the sampling activities have been used for the calculations. In Huzhou, the actual reduced feeding rate and capacity of feeding waste (12 hours/day and 400 Kg/h) have been considered for the calculation of emission factors. An annual average operating time of 330 days/year was used in the calculations. The annual waste throughput was approximately 1,600 tons. In Jinan a capacity of feeding waste of 800 Kg/h for 10 hours/day has been considered. An annual average operating time of 310 days/year was used in the calculations. The annual waste throughput was approximately 2,500 tons.

Table 1a. Huzhou sampling results and comparison with Toolkit release factors

Incinerator	Emission Round 1 µgTEQ/T	Emission Round µgTEQ/T	Toolkit release factors		
			Type of plant	Air µgTEQ/T	Residue µgTEQ/T
Stack 1	1,216	33	Uncontrolled batch type combustion, No APCS	40,000	200
Stack 2	391	24	Controlled, batch type combustion, No or minimal APCS	3,000	20
Stack at closing down operation	955		Controlled, batch type combustion, good APCS	525	920

Incinerator	Emission Round 1 µgTEQ/T	Emission Round µgTEQ/T	Toolkit release factors		
			Type of plant	Air µgTEQ/T	Residue µgTEQ/T
Fly ashes	1,260	1,620	High technology, continuous controlled combustion, Sophisticated APCS	1	150

Before the modifications (Round 1), the concentrations of PCDD/F were very high (some tenths to hundreds of ng TEQ/Nm^3 at the stack). The first sampling round confirmed that the heat exchanger can be a critical point for PCDD/F appearance and very high values were recorded here (data not reported in the table) Moreover, the start-up and close-down phases of the combustion process were proved to be one of the main sources of pollutants and therefore a continuous operation should be introduced.

After the modifications (Round 2) PCDD/F stack emissions were reduced in a large extent due to process improvement and bag filter maintenance. The PCDD/F values after the heat exchanger were also reduced. PCDD/F increased in solid residues, like fly ashes, due to an increased efficiency of the bag filter, which was regularly cleaned. Emission factor for air emission were reduced from 390-1,220 µg/ton feed to 24-33 µg/ton feed (class 3-4 of the toolkit). Emission factor for residue emission did not show a sensitive reduction (1,600 µg/ton feed) and the still lies in class 3 of the toolkit.

Table 1b. Jinan sampling results and comparison with Toolkit release factors

Incinerator	Emission Round 1 µgTEQ/T	Emission Round 2 µgTEQ/T	Toolkit release factors		
			Type of plant	Air µgTEQ/T	Residue µgTEQ/T
Stack 1	69.5	19.8	Uncontrolled batch type combustion, No APCS	40,000	200
Stack 2	48.9	44.8	Controlled, batch type combustion, No or minimal APCS	3,000	20
Stack at starting operation	82.2		Controlled, batch type combustion, good APCS	525	920
Fly ashes	5.7	6.9	High technology, continuous controlled combustion, Sophisticated APCS	1	150

The same explanatory notes can be applied for Table 1b that have been described for Table 1a. The data on Table 1b however shows that the Jinan incinerator has a more efficient APCS, therefore the emission values are lower. It should also be noted that the medical waste throughput of the Jinan incinerator was 3,100 tons per year.

The effectiveness of a technological improvement consists in the reduction (or increase) of the emission rate of the pollutants or sum of pollutants, which the modification is intended for. Effectiveness is usually measured as an annual output reduction, but can also be expressed as emission factor reduction. It should be noted that the Jinan incinerator's APCS has shown a higher efficiency

that the Huzhou incinerator's APCS as it can be seen from the emission values at the closing and starting of the operation.

For an economically correct comparison of technology options, the analysis must be incremental. In calculating a cost-effectiveness ratio for a given modification, the increments in cost respect to the previous technology option must be considered. In this study the same decrease (or increase) of PCDD/F for the whole duration of the evaluation has been considered.

Financial analysis

Description of methodology

A financial appraisal of the project has been based on the cash flow projection in order to calculate two main indicators: financial rate of return (FRR) and financial net present value (FNPV). FRR has been calculated specifically on investment (FRR/C) and on own capital (FRR/K), the same procedure has been done for FNPV. All calculations have been done under the assumption of certain set of financial conditions. The financial analysis consists of financial flows required for the introduction of BAT/BEP at the medical waste disposal facilities of the project sites, operating costs, revenues and sources of financing and cash flow analysis.

An important step of evaluation has been to identify the value of revenues and costs. The main components were:

- Costs of capital expenses acquiring BAT/BEP,
- Costs for operating BAT/BEP,
- Medical waste collection,
- Revenues of the project generated by the medical waste disposal, and
- Defining of financing structure of the project.

A model that has not taken into account the financial sources has been used in the first step of the financial evaluation. The FRR/C and FNPV/C were calculated using this assumption. As these values might not be attractive for investors in environmental projects, a modified method for determining the financial gap was used to calculate FRR/K and NPV/K. Although the value of grant in this project was already given, the financial structure was tested via acceptable results of FRR/K and NPV/K. The sustainability of the project was tested through the cash flow forecast as well as the affordability of the project.

From financial points of view two project activities have major importance:

- Incineration technology, and
- Non-combustion technology

The non-combustion technology was not financially evaluated because the basic data for evaluation was not available at the time of evaluation. However, some assumptions have been taken into account that shows a win/win scenario. The overall medical waste profile in China shows that approximately 62 % of the medical waste is glass. Currently, a large portion of the glass goes to the incinerators that create several problems for the technological process flow. The melted glass ends up in the slag as a mixture with the bottom ash. The current practice is that the glass is segregated at this point of the process manually when the slag has cooled down. It presumes a batch type of operation that has serious disadvantages. The starting up and closing down periods are prime to facilitate PCDD/F generation. One of the options to solve this problem is to introduce a mechanical devise that would separate the glass from the bottom ash during a continuous incineration process. Another option is to segregate the glass in the medical waste at site in the medical institutions and treat with alternative non-combustion technology such as heat treatment in autoclave. This approach would promote the emergence of a new industry and generate new jobs.

It can be safely assumed that both the capital and the operating expenses of the thermal, non-combustion technologies are less than the incineration, therefore the existing fee-based system would sustain the introduction of such a technology. In the analysis RMB 2 per hospital bed per day or RMB 4 per kg of medical waste has been used for calculation of revenues with the assumption that over 90 % of the fee has been collected.

As no supporting study has been available on application of the alternative non-combustion technologies for treating medical wastes in China, therefore only a very simple calculation based on the capital, operating and maintenance costs of 4 pieces of equipment has been made to obtain the incremental costs of PCDD/F reduction. The procurement of these pieces of equipment is foreseen in the project budget. Calculating the budget allocations made available for procuring 4 pieces of non-combustion equipment, the quantity of estimated avoided releases of by-products by means of BAT/BEP demonstration and adoption through alternative treatment processes is 2.59 g toxic equivalents per year in the project areas and the incremental cost is amounting to US$66,274 per g TEQs. The fee-based system can sustain the costs.

Assumptions

For the financial analysis the following basic assumptions have been made:

- macroeconomic indicators (exchange rate, inflation, etc.),
- financial status of beneficiary,
- economic life of the project,
- project costs (capital, operating, maintenance, financial and eligibility of costs), and
- project revenues.

Discount rate

All financial indicators in the financial and economic analysis are calculated at 10% discount rate in accordance with standards of international banks for such projects. A discount rate is required to reflect the effect of timing on the present value of all the costs, benefits and effectiveness (as the reduction efficiency of abatement devices can decrease with time). The values derived by discounting are the present values. In our case incremental present value has been calculated.

Interest rate

The interest rate of commercial loans is in the range of 7-10%. The use of correct price adjusters can be avoided if correct interest rate is considered in the calculation. Therefore, real interest rates should be used to remove the effect of inflation, instead of nominal ones. In the financial analysis 10 % interest rate has been used.

Costs

Costs are expressed by two components: an initial capital investment, and annual operating and maintenance costs. Moreover, savings, avoided costs and revenues must be calculated to obtain the net annual costs. When comparing costs the value change of goods and services in time should be considered. Moreover raw costs should be expressed on an equivalent price basis of a “common” year. The baseline “common” year is the year 2006 as the project would start in 2007. Prices of year 2007 should be related to year 2006 with an appropriate price adjuster, price index and price deflator indexes.

Amortisation

Amortisation periods for different technology options are also required and it is generally assumed in a 10-yeard period since all technology options last at least 10 years, and would be likely to be resalable when remaining lifetimes of plants are shorter than this.

Total Present Value or Discounted Cost (y) = Σ (Undiscounted $Cost_y$) / $(1 + d)^y$
d= discount rate =0.1 (10%)
y = project lifetime

There are many methods of calculating the total equivalent annual costs over a period of time. In this study the procedure suggested by the IPCC European BREF on Cross media Effect 2005 has been used, because it is more flexible and more widely used. The procedure suggested consists in the calculation of the present value of both total cost streams (investment expenditure plus net operating and maintenance cost). A capital recovery factor is applied in order to have the incremental "equivalent annual cost".

$$\text{Total incremental equivalent annual cost} = \left[\sum_{y=o}^{n} \frac{(IC_y+IO_y)}{(1+d)^y} \right] * \left[\frac{d\,(1+d)^n}{(1+d)^n-1} \right]$$

Where:
IC: total incremental capital cost
IO: total net incremental operating and maintenance costs
d: discount rate
n: estimated economic lifetime
y=o base year of assessment

The incremental cost/effectiveness is simply the ratio between the incremental equivalent annual cost and the reduction of PCDD/F concentration obtained in the first year (which should be considered unchanged in the period of time n).

The calculations have been carried out as follows. Firstly the incremental costs (capital, and net operating costs) and the effectiveness have been calculated, then the cost/effectiveness ratios for the optimized process (modified scenario), both for the PCDD/F emission in air and the total PCDD/F emission in air and solid residues.

It is not possible to compare the ratio obtained for the modified scenario with that of the baseline, since a value of effectiveness for the baseline scenario is not available (the baseline of baseline would be the absence of the incineration plant in which case an increase of emissions would be observed, not a decrease). Comparisons of cost/effectiveness ratios are possible only when two or more different implemented options are evaluated, starting from a common baseline, but in this case only one set of modifications are available. Therefore in this business plan only the ratio calculated for Huzhou with the ratio of Jinan can be compared.

Table 2a. Results of the financial analysis at Huzhou

	Capital cost (RMBs/year)	**Operating Cost (RMBs/year)**	**Benefits (RMBs/year)**	**Emission rate (mg TEQ/year)**
Baseline scenario	3,930,000	1,024,800	6,255,000	Air= 1,273 Total=3,270
Modified scenario	4,060,000	1,069,700	6,277,000	Air=45.2 Total=2,623

	Capital cost (RMBs/year)	Operating Cost (RMBs/year)	Benefits (RMBs/year)	Emission rate (mg TEQ/year)
	Incremental capital cost (RMBs/year)	Incremental operating cost (RMB/year)	Incremental Benefits (RMBs/year)	Effectiveness (mg TEQ/year)
	130,000	44,900	22,000	air=1,228 Air+Residues=647

Total present value based on the incremental discounted financial flow = RMB 284,782

Total incremental equivalent annual cost = RMB 46,347

Cost/effectiveness ratio in RMB/mg reduction in TEQ in air = 46,347/1228 = 38
Cost/effectiveness ratio in RMB/mg reduction in TEQ in air + residues (total releases) = 46,347/647 = 72

If one wanted to express the reduction rate in percentages the calculations would give a range of 99.9% - 99.999% reduction rate of the PCDD/F releases.

The cost/effectiveness evaluation as far as the air emissions concerned resulted in an incremental annual cost of approximately RMB 38,000 per g of reduced PCDD/F. It is equivalent to approximately US$ 4,909 per g of reduced PCDD/F. If the total emission is considered, since, as expected, in the solid residue an increased level of PCDD/F was detected, a higher value, approximately RMB 72,000 per g of reduced PCDD/F, equivalent to approximately US$ 9,300 was obtained. The exchange rate of Bank of China on 2 March 2007 was used: RMB 1 = US$ 0.1219.

Table 2b. Results of the financial analysis at Jinan

	Capital cost (RMBs/year)	Operating Cost (RMBs/year)	Benefits (RMBs/year)	Emission rate (mg TEQ/year)
Baseline scenario	7,360,000	1,985,038	11,625,000	Total=147
Modified scenario	7,428,000	2,168,238	11,625,000	Total=80
	Incremental capital cost (RMBs/year)	Incremental operating cost (RMB/year)	Incremental Benefits (RMBs/year)	Incremental effectiveness (mg TEQ/year)
	68,000	183,200	-	Air+Residues=67

Total present value based on the incremental discounted financial flow = RMB 1,306,253

Total incremental equivalent annual cost = RMB 212,587

Cost/effectiveness ratio in RMB/mg reduction in TEQ in air + residues (total releases) = 3173

The cost/effectiveness evaluation for the total emission resulted in an incremental annual cost of approximately RMB 3.173 million per g of reduced PCDD/F. It is equivalent to approximately US$ 386,810 per g of reduced PCDD/F. The exchange rate of Bank of China on 2 March 2007 was used: RMB 1 = US$ 0.1219.

Affordability Analysis

As shown in the above cost analysis tables, the total capital, operating and maintenance costs are less than the benefits, therefore with the assumption that the fee-based system for supporting medical waste management, treatment and disposal provides the required cash flow, the project is affordable.

Break-even point

Break-even point is defined as the equilibrium point at which the variable margin equals the fixed costs. In the financial analysis it is in the first year of the operation. It is noteworthy that the Huzhou incinerator plant may also generate incremental benefits that could be used for unexpected expenditures emerging through the project such as requirements of additional analytical samplings and determinations.

Internal rate of return

Internal rate of return is the discount rate at which the present value of cash inflows is equals to the present value of cash outflows. In the financial analysis the internal rate of return is close to 100%. In other words if the process optimization and process improvement measures were carried out successfully the BAT/BEP performance can sustainably be maintained.

Further financial and business considerations

It should be noted that the survey data on medical waste disposal generated by the Consulting Department of the Chinese Academy for Environmental Planning have shown reduction results in the same magnitude. In this survey several assumptions have been made as follows:

- Medical waste throughput volumes have been based on the nominal built-in capacities of the incinerators;
- The release factor of the Toolkit for controlled batch type combustion with good air pollution control system (APCS) has been used in the calculations (525 μg/ton medical waste feed);
- The release factor of the Toolkit for controlled batch type combustion with no or minimal APCS has been used in the calculations (3,000 μg/ton medical waste feed); and
- Incremental release reduction costs have been calculated and used for the business projections.

Based on the Italian Government financed pilot BAT/BEP project and the survey of the Chinese Academy for Environmental Planning a linear extrapolation have been used to expand their results for a large number of incinerators. The inventory of the Nationwide Investment Programme in Medical Waste Management shows 147 existing dedicated incinerators. Out of these about 77 have good APCS and another 70 has no or minimal APCS. It has been assumed that the measures to be applied to introduce BAT/BEP for the 3 incinerators involved in this Project and further 74 incinerators with good APCS would be similar to those of the Italian funded project. Consequently, the costs of the BAT/BEP application would be in the same magnitude.

The currently available experience and PCDD/F release data have been obtained from the process improvement and optimization of only 2 medical waste incinerators, namely Huzhou and Jinan. As two samples from a population of 77 (the number of incinerators with good APCS) cannot be statistically representative, an arbitrary round figure, close to the median, has been selected for further use. This TCDD/F release reduction figure is US$ 150,000/g TEQ.

The estimated reduction values are in Table 3.

Table 3. Estimated PCDD/T reduction values

Number of incinerators	TCDD/F release (air +residues) reduction (gTEQ/year)	Cost of TCDD/F release reduction (gTEQ/ US$)
3	1.94	150,000
74	47.88	7,182,000

As it has been shown in the financial analysis the project would be financially sustainable from its start in case the fee-based medical waste management, treatment and disposal system in adequately functioning. In other words the project budget would be sufficient to sustain the costs of starting up BAT/BEP application in the 3 incinerators involved in the project.

Finally it should be noted that the above financial analysis has been carried out on the basis of limited experience of a single pilot project, backed up by modelling data based on an extensive nationwide survey. The project therefore should focus on extensive capacity building programmes designed for the managerial and technical personnel planning and operating the medical waste management, treatment and disposal systems. In addition detailed field survey in combination with analytical sampling and testing PCDD/F levels should be carried out to validating the survey results of the Chinese Academy for Environmental Planning as the first step of BAT/BEP dissemination in the medical waste management sector.