



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

TERMS OF REFERENCE

For provision of services for the domestic market analysis of the project

“Environmentally Sound Management of Medical Wastes”

SAP ID 104160, Grant 200000252

The Project

The Terms of Reference (TOR) is established to further those activities to be undertaken by the contractor for the GEF project “Environmentally Sound Management of Medical Wastes in India”.

I. GENERAL BACKGROUND INFORMATION

Bio-medical waste (infectious healthcare waste) is hazardous with a potential to spread infection and generation and release of high levels of unintentionally produced persistent organic pollutants (uPOPs). Bio-medical waste therefore requires safe management throughout the complete life cycle in order to safeguard public health and protect environment. Healthcare institutions (hospitals, healthcare centres, primary health centres, community centres, etc.) generate large amount of waste that fall into different categories. Out of this about 75% to 80% is non-risky or falls under general healthcare waste category that is comparable to domestic waste. The disposal of the remaining 20-25% infectious wastes originating from healthcare establishments is instead likely to have adverse impact on both human health and environment. However, experiences have shown that when this waste is managed properly, the risk to both human beings and the environment is reduced to a very large extent.

In the past, even in developed countries, bio-medical waste was not considered as a special type of hazardous waste, which needed to be handled scientifically, hence had not received much attention. Bio-medical wastes were mainly incinerated on-site or directly landfilled without prior treatment. However after 1980, health and environmental regulations were strengthened in light of enhanced scientific knowledge and supported by increasing public awareness of the risks. Scientific research institutions concluded that disposal of bio-medical waste by uncontrolled incineration would lead to severe environmental pollution. Incineration of the significant fraction of polyvinyl chloride (PVC) plastic and other chlorine compounds in bio-medical waste can form PCDD/F (dioxin/furans), which are emitted into the air or captured in residues in case the facility does not have a sophisticated air pollution control device. Arising from international treaties, particularly the Stockholm Convention 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 bio-medical waste, has gradually been replaced or supplemented by alternative non-incineration technologies that do not emit significant air emissions and in particular POPs.

In India too, until early 1990s, healthcare waste management was a neglected issue. It caught the attention of policy makers when stockpiles of bio-medical waste lay untreated leading to spread of infections within the

hospitals and in the community. Also pressure groups like social workers, NGOs and media drew the attention of the Government of India to bring legislation to handle this problem. The Bio-Medical Waste (Management and Handling) Rules of 1998 was notified bringing to the focus the harmful effects of unsafe management of biomedical waste. Due to the notification of the rules, many of the medium and large healthcare facilities installed individual incinerators with sub-optimal efficiency leading to high amount of air pollution.

Article 5 of the Stockholm Convention on Persistent Organic Pollutants (POPs) requires Parties to continue minimization and, where feasible, ultimate elimination of releases from unintentional production of chemicals listed in Annex C. PCDD/PCDF are unintentionally formed and released from thermal processes involving organic matter and chlorine as a result of incomplete combustion or chemical reactions. Incineration of medical wastes falls into the source categories that have the potential for comparatively high formation and releases of the PCDD/F into the environment.

With the Republic of India becoming a party to the Stockholm Convention on (POPs) in May 2002 and ratifying it in January 2006, the country was obliged to comply with the requirements of the Stockholm Convention. It is in this context that the project on “Environmentally Sound Management of Medical Waste in India” has been approved by GEF where the Ministry of Environment and Forests, Government of India is the national executing agency and the United Nations Industrial Development Organization (UNIDO) is the implementing agency. The project aims to assist the country in safe and sound management and disposal of 180,000 tons of healthcare wastes generated annually, which is 484 tons per day. Ample progress has been made regarding segregation at source, however, improvement is needed, which is a continuous process. Segregation at source is the crux of bio-medical waste management as only about 15% to 20% of waste is infectious in nature. The quantum of medical waste that is generated in India is estimated to be 250-400 gm per bed per day in a hospital and 200-300 g per bed per day in a general practitioners’ clinic (e.g. a 100 bedded hospital will generate about 40 kg of hospital waste/day). A detailed situation analysis was carried out during the preparatory phase of the project in 5 selected states of India namely Gujarat, Karnataka, Maharashtra, Odisha and Punjab covering bio-medical waste management in healthcare facilities and Common Biomedical Waste Treatment Facilities (CBWTFs) covering 57 CBWTFs, which is 40% of total CBWTFs in the country. The amount of PCDD/F releases was estimated to be 105.44 g I-TEQ/y using the UNEP toolkit. By proper segregation and either by applying non-incineration techniques or upgrading existing incinerators more than 50% of dioxin and furans reduction can be achieved.

The project is faced with a variety of barriers that will need to be addressed to ensure its successful implementation and achievement of project objectives. During the project preparatory phase, several broad based and specific barriers were identified as follows:

- Biomedical waste or healthcare waste management systems are still evolving at different levels and are under multiple organizations. In this respect, existing rules and regulations under environmental protection legislations, especially BMW rules of 1998 require proper review, augmentation and enforcement.
- Existing opportunities for training and capacity building in healthcare waste management are few and the same are inadequate.
- Many existing CBWTFs are inefficient in many places, hence need upgrading and review for alternative cost-effective and efficient technologies.
- System of monitoring of CBWTFs and bio-medical waste transportation systems need to be strengthened.
- Budget allocation for bio-medical waste management is inadequate in both government and private sectors.
- Waste generated during immunization and during domiciliary management of chronic diseases form a significant quantity and needs to be taken care of. It is the most neglected area.
- Pharmaceutical waste management and liquid waste management are neglected areas.
- Hazardous waste management facilities are inadequate and need to be developed in many states especially to final disposal of incineration ash.

- No proper regulations / guidelines for chemical waste management in healthcare waste management.
- Health of CBWTF personnel is not regularly monitored, no system of placement and periodical examination exist.

To address the above the project will:

- Review the existing implementation of the Biomedical Waste (Management & Handling) Rules of 2016 in five States and bring out the gaps in the Hospitals under the study.
- Develop model hospitals through the involvement of a total of 140 healthcare facilities across the 5 participating States of Gujarat, Karnataka, Maharashtra, Odisha and Punjab (i.e. 4 large hospitals with more than 500 beds, 8 medium hospitals with bed strength of 101-500 beds and 16 small health care facilities with less than 100 beds in each of the 5 participating States) by providing support for efficient and environmentally sound management of bio-medical wastes generated
- Develop a model district in each of participating states for sound management of bio- medical wastes. This activity will also involve study of operations and technologies at Centralised Biomedical Waste Treatment Facilities (CBWTFs) situated at the identified demonstration districts of 5 participating States. The study will recommend and implement measures to enhance the efficiency and level of environmental compliance of the participating CBWTFs.
- The important issue of medical waste management would be comprehensively addressed with a long term vision of creating an enlightened creed of eco-sensitive future healthcare professionals. It would necessarily imply targeting the budding doctors at the time of their education in medical colleges as medical waste management is more an issue of moulding attitudes rather than imparting extensive knowledge. Curriculum developments across specialities like surgery, orthopaedics, OBG, etc. which is high end waste generating specialities is desirable and will yield quicker benefits by reinforcement of HCWM principles at various levels of curriculum.
- The success of such project depends on healthcare functionaries internalising and practising various waste management procedures on routine basis, which could be achieved through sustained training of the functionaries. Realising this fact, the project places utmost importance to the activity of training and development of such material, which could be used by the various levels of healthcare functionaries. Conducting training programmes for all those involved with handling of medical waste and implementation of Bio Medical Waste (Management & Handling) Rules 2016 is also envisaged.

II. AIM OF THE PROJECT

The overall objective of the project is to promote a country-wide adoption of best available techniques and best environmental practices (BAT/BEP) in healthcare institutions of widely differing in their complexity and size as well as in the evolving bio-medical waste management infrastructure and industry in a manner that protects human health and reduces adverse environmental impacts. The objective can be achieved through private-public partnership (PPP) covering, but not limited to the following approaches: segregation, decontamination and compaction of the medical wastes and thus reducing its volume to be disposed of by introducing alternative technologies; enhancing and optimization of incineration technologies, raising awareness and dissemination of know-how; incorporation of management systems; innovation and adaptation of appropriate and affordable technologies and techniques; introduction of participatory funding systems and enhancement of relevant existing laws and regulations.

The immediate objectives of the project are as follows:

- Harmonization of environmental and healthcare policy and regulatory instruments through appropriate networking for creation and promotion of environmentally sound management of bio-medical waste, disposal sector and market.

- Strengthening of institutional capacity for environmentally sound management (ESM) of bio-medical waste, in particular in large, medium and small healthcare facilities in 5 selected States namely Gujarat, Karnataka, Maharashtra, Odisha and Punjab.
- Facilitation and promotion of private-public partnership (PPP) to improve support and supply capacities in bio-medical waste management within the healthcare facility perimeter.
- Facilitation and promotion of PPP to improve local technological and manufacturing capacities in bio-medical waste transport and disposal sectors with specific reference to avoid generation of PCDD/F and other unintentionally produced POPs releases by applying BAT/BEP measures.
- Augment the existing systems of handling and management of Bio-medical waste in the country.
- Demonstration of participatory funded and integrated systems for bio-medical waste management and disposal in 5 participating States namely Gujarat, Karnataka, Maharashtra, Odisha and Punjab.

III. THE SCOPE OF THE PROPOSED CONTRACTED SERVICES

The Terms of Reference (TOR) sets out the responsibilities of the contractor to undertake the project activities set out in the preceding sections. The objective of the contract is to carry out domestic market analysis of bio-medical waste management and disposal including best available technologies and best environmental practices in 5 participating States (Gujarat, Karnataka, Maharashtra, Odisha and Punjab).

Market size, trends, growth rate and profitability

Healthcare waste includes waste generated within healthcare facilities such as hospitals, research centres and laboratories related to medical procedures. It includes waste generated from minor sources such as self-administration of insulin, home dialysis, and recuperative care. Medical waste management is essential to protect the general public, environment, workers, especially sanitation and healthcare workers, who are at high risk of exposure to medical waste as an occupational hazard. The medical waste management involves various steps such as generation, accumulation, storage, handling, transport, treatment, and disposal. The market size of bio-medical waste disposal is defined through the market volume and the market potential. About 80% of the medical waste generated every year consists of plastics, papers, and other materials that are quite similar to general household or office waste, but the remaining 10%-25% consists of bio-medical waste materials such as used syringes, blood-soaked bandages, cultures, stocks, unused or expired medicines, and many more, which are harmful to both humans and the environment alike. Such waste products need to be disposed of properly. Poor handling of these wastes has the potential of exposing patients, waste handlers, and healthcare professionals to serious infections.

The market volume exhibits the totality of all bio-medical wastes generated. The volume is therefore dependent on the quantity of generators and the number of patients. Furthermore, the market volume is either measured in quantities or qualities. The quantities can be given in technical terms, like gross weight, or in numbers of items. Qualitative measuring is made by the type of waste such as non-hazardous waste or hazardous waste (infectious and pathological waste, sharps, pharmaceutical waste, other medical waste, etc.).

Besides the market volume, the market potential is of equal importance. It defines the upper limit of the total demand and takes potential clients into consideration. Although the market potential is rather fictitious, it offers good values of orientation. The relation of market volume to market potential provides information about the chances of market growth. The market growth can also be negative in case of better segregation at

site of generation. If a larger proportion of non-hazardous medical waste is segregated and recycled, the volume of treatable and disposable bio-medical waste would be less.

Market trends are the upward or downward movement of a market, during a period of time. Changes in the market are important because they often are the source of new opportunities and threats. Examples include changes in economic, social, regulatory, legal, and political conditions and in available technology, price sensitivity, including transport costs. The market trends can also be declining in case of better segregation at site of generation. If a larger proportion of non-hazardous medical waste is segregated and recycled, the volume of treatable and disposable bio-medical waste would be less. At the same time it would bring new opportunities for the recycling industry.

A simple means of forecasting the market growth rate is to extrapolate historical data into the future. While this method may provide a good estimate, it does not predict important turning points. A better method is to study market trends. Such drivers serve as leading indicators that are more accurate than simply extrapolating historical data. The market growth rate may influence the full implementation of BMW rules of 2016.

The cost structure is important for identifying key factors for success. The cost of bio-medical waste disposal should be affordable for the healthcare facilities, appealing for the collection and transport companies, and should provide a margin to the CBWTFs. At least the following factors must be taken into account in the cost estimate:

Investment costs: cost of the land; cost of building/purchasing infrastructures (such as an incinerator, a storeroom, or a waste burial pit); vehicles; on-site means of transport (such as wheelbarrows); bag stands or containers; personal protective equipment (clothes, boots); and

Operating costs: fuel or electricity or water; spare parts, maintenance of treatment facilities; staff salaries; sharps containers and bags; vehicle maintenance; personal protective equipment (gloves, masks); and training.

The scope of work will include, but not limited, to the following activities:

No.	Activity	Timeframe
1	Develop sampling criteria to (i) select HCFs from the model districts and few representative HCFs (large and medium sized); (ii) select categories of bio-medical waste handling equipment depending on their criticality; and (iii) select vendors for demand and supply assessment	1 st month (March 2019)
2	Conduct site visits to selected 3 HCFs (large, medium and small) in each of the 5 participating States for prioritization of discrete units and discussion with relevant key stakeholders including government officials and district healthcare authorities	2 nd to 4 th months (April – June 2019)
3	Conduct bio-medical waste generation forecasting by HCFs and treatment in CBWTFs through data collection from key stakeholders across the 5 participating States.	
4	Assess the volumes of bio-medical wastes generated by HCFs as well as the bio-medical wastes treated by CBWTFs in the 5 participating States	
5	Compile bio-medical waste volume data gathered and analyze the trends of biomedical waste generation and treatment then compare with the waste volumes treated in the CBWTFs according to their inventories. Analyze the discrepancies of data, if any, of the previous activity	

6	Conduct workshop for forecasting results, sampling methodology and sample size for all 3 aspects, approach and methodology for market analysis	4 th month (June 2019)
7	Prepare demand-supply assessment for equipment and vendors / suppliers including benchmarking	5 th – 6 th month (July to August 2019)
8	Prepare a typical cost structure for bio-medical waste generation, accumulation, storage, handling, transport, treatment, and disposal for each participating States	
9	Analyze participatory mechanisms in financing bio-medical waste management and disposal	
10	Analyze capacity utilization of CBWTFs to reach financial viability	
11	Analyze cost-benefit of selling recyclable products	
12	Analyze the effect on cost structure of introducing new and more cost efficient technologies	

IV. GENERAL TIME SCHEDULE

The subcontract will start upon signature of Contract by UNIDO and the Contractor and will have a total duration of seven (7) months.

The total costs of the subcontract will be paid in a series of payments against set milestones. These milestones will be represented by

- (a) signature of the Contract;
- (b) the delivery of formal reports on set milestones, including – as annexes, the activity progress reports of the contractor, its national experts and subcontractors.

A total of **four (4) payments** will be made by UNIDO. The amounts to be transferred at each payment have been assessed according to the phasing of project activities as set out in the table below:

Description	Time Schedule
Initial payment: upon signature of the Contract and submission of kick off report and work plan	end of month 1 of contract implementation
2 nd payment: upon delivery and acceptance by UNIDO of the Progress Reports required for Activities 1-6	end of month 4 of contract implementation
3 rd payment: upon delivery and acceptance by UNIDO of the Progress Reports required for Activities 7-12	end of month 6 of contract implementation
Final payment: Upon delivery and acceptance by UNIDO of the - Final Report comprising of: - Summary of activities undertaken under the subcontract	end of month 7 of contract implementation

V. CONTRACTOR EXPERIENCE

The Contractor shall have experience in assignment similar to the ones described in these Terms of Reference and shall provide at least three (3) project references.

VI. PERSONNEL IN THE FIELD

The Contractor shall provide personnel including technical and support staff exclusively for this project. The key personnel to be engaged in this contract should collectively have the following qualifications /experience:

- Advance degree in Environmental Sciences/ Environmental Engineering/Microbiology/ Life Sciences/ Business Administration or any other interdisciplinary subject;
- Minimum 3 years of experience in Waste Management, Data analytics and stakeholder consultations, Strategy, Audits, Sustainability and Benchmarking;
- Experience and understanding of the biomedical waste life cycle;
- experience in communication of environmental issues to government, public and private stakeholders;
- knowledge in requirements of the Stockholm Convention, particularly in uPOPs related issues
- Fluency in English and Hindi (however could be replaced by translation/interpretation services); knowledge of any of the regional languages of Gujarati, Kannada, Marathi, Odiya and Punjabi will be an asset

VII. DELIVERABLES

Reports for submission to UNIDO should be prepared in English and be made available in both hardcopy and electronic formats. The contractor will be responsible for compiling the reports of the national experts and subcontractors it engages to undertake any of the activities set out above. The following are the deliverables:

Activities	Deliverables	Payment
	- Kick off report and workplan	1 st payment
<i>Activities 1-6</i>	<ul style="list-style-type: none"> - Summary report on sampling criteria for (i) selecting HCFs from model districts and few representative HCFs; (ii) categories of bio-medical waste handling equipment; (iii) inventory report on vendors for demand and supply - Summary reports of site visits to selected HCFs in 5 participating States; - Assessment report and compiled data on volume of bio-medical waste generated and treated - Workshop proceedings on forecasting results, sampling methodology and sample size for all 3 aspects, approach and methodology for market analysis 	2 nd payment
<i>Activities 7-12</i>	<ul style="list-style-type: none"> - Demand supply report for each of the 5 participating States - Vendor and equipment wise demand supply report - Report on cost structure of bio-medical waste from generation, accumulation, storage, handling, transport, treatment and 	3 rd payment

	disposal for each of the 5 participating States - Reports on participatory mechanisms in financing; capacity utilization of CBWTFs to reach financial viability; cost-benefit of recyclable products and cost structure of introducing new and more cost efficient technologies	
Final report	- Summary of activities undertaken including recommendations	Final payment

VIII. EQUIPMENT COMPONENT

The contract does not include supply of equipment.