

Medical Waste Management for Ramallah District

Feasibility Study



Final Report

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Acronyms

EHD	Environmental Health Department
EQA	Environmental Quality Authority
HCW	Health Care Waste
KFW	German Bank for Development
LGU	Local Government Unit
MOH	Ministry of Health
MOLG	Ministry of Local Government
MW	Medical Waste
NIS	New Israeli Shekel
PCBS	Palestinian Bureau of statistics
PHC	Primary Health Care
PHCC	Primary Health Care Centers
PLC	Palestinian Legislative Council
PS	Private Sector
RJSC	Regional Joint Service Council
UNDP	United Nations Development Program

Executive Summary,

Having recognized the need for a more coordinated and regionalized approach for the handling of the Health care waste (HCW) in the area, and in accordance with the Draft Master Plan for Healthcare Waste Management drafted in 2005, and in accordance with the draft bylaw of 2008 for the Medical waste management, the UNDP has decided to look into the possibility of expanding the scope of the on going program designed to look into the management of the Ramallah Government Hospital HCW management through the inclusion of the three cities of Ramallah, Al Bireh and Bitunia.

The purpose of this report is to determine if the extension of the scope of work of the ongoing Medical Waste Management Project to cover all service area of Ramallah, Betonia and Albireh Municipalities is feasible or not. The feasibility was decided once all evaluation criteria were proven in favor of the extension, and these were:

- The economic/ financial feasibility,
- Environmental feasibility,
- Technical feasibility, and,
- If in accordance with the overall waste management policy and health care waste management policy.

Given the fact that there are a number of health services providers in the area, and as a donor, the issue of inclusion within the system was left to the direct beneficiary, Ministry of Health, to decide who should be part of the proposed system.

With the limited available recorded information on generated waste quantities, it was recommended by the project manager to use the given figures by the main stakeholders, UNDP and the MOH within this report. The data provided by the UNDP which is based on a field survey that covered 40 health service providers in the area was used to estimate the expected generated amounts of HCW in the area where the HCW will not exceed 15% (as maximum) of the general waste.

The Draft Master Plan has referred to a number of generation figures for the HCW in the West Bank. These figures are 1.29Kg/bed/day, 1.27Kg/bed/day and 1.23Kg/bed/day. No final agreed upon figure was agreed among all stakeholders. Based on this the consultant has adopted the average figure of 1.26kg/bed/day as health care waste.

For private hospitals waste, a 4.7 kg/bed/day as general waste was used with 0.7kg/bed was considered as medical waste (based on the 15% ratio) at the same time it was decided to use a 3.6kg of waste as generated by each patient visiting a clinic per month, out of which only 0.5 kg of medical waste is considered (all these figures are based on the UNDP survey report).

Given all above, and through meetings with the relevant stakeholders, it was made clear by the MOH that a dual system is to be built. The first system will deal with waste generated by the governmental health services providers and the second

separate system is to be in place to handle the waste generated by the private sector.

The report is structured as was outlined in the terms of reference starting with this summary and a background of the original project including the expected deliverables and work methodology.

The report is based on available figures provided by the management team and the counterparts. The basic findings section covered the summary of information being provided by the stakeholders met or through the related literature being reviewed. The selection of extension system is a review of the given data and the analysis leading to the conclusions; this has covered the assumptions and the technical options, and then ended by a waste minimization plan and the final recommendations.

The two major components of the analysis are the extension to include the governmental health services providers in addition to the Ramallah governmental hospital which is covered by the original project and the private sector health services providers.

With this, the extension is of two tracks, one is to cover the governmental health service providers and this was already discussed between the government and the UNDP where it was recommended to proceed with it, and the other which is dependent on the findings of this study is the inclusion of the private sector health service providers. The conclusions of the report were in favor of implementing both tracks.

It should be noted as indicated above that no new field data was supposed to be generated through this task, but to use the data collected by the UNDP team.

Medical Waste Management for Ramallah District

Feasibility Study

1.0 Introduction

1.1 Background:

Improvement of Medical Waste Management in Ramallah District is a project funded by the Government of Japan. UNDP/PAPP is serving as the Executing and Implementing Agency for the project.

The Beneficiary Agencies/Counterparts are the Environment Quality Authority (EQA), the Ministry of Health (MOH) represented by Ramallah Governmental Hospital and the Ministry of Local Government (MOLG) represented by the Municipality of Ramallah.

The major activities of this project are:

- Assess Medical Waste Management (MWM) and the current practices including collection, segregation, primary treatment, storage, transportation and final treatment within Ramallah Governmental Hospitals.
- Review and further develop a user friendly Medical Waste Management System/Manual for Ramallah Governmental Hospital.
- Improvement and further Development of the draft available of the National Regulations and Guidelines (to be used by the Health Care facilities and by the Service Providers) to control, manage and treat the Medical Waste in order to protect the public health and safeguard the environment.
- Assess the Medical Waste Management Systems within Ramallah Municipality, including current practices, problems and needs. Based upon the assessments report, develop a medical waste management system (manual) that includes and clarifies all responsibilities and appropriate procedures regarding handling, collection and transfer of medical waste.
- Conduct training activities to strengthen the institutional capacities of the stakeholders and the main beneficiaries of the project.
- Procurement of necessary equipment for Ramallah Governmental Hospital and Municipality of Ramallah.

This report shall be used by UNDP to decide on further expansion of the current program designed to handle the Ramallah HCW. After reviewing the available literature and after meeting the stakeholders, it is important to keep the following issues in mind:

- 1- The master plan for healthcare waste management has identified the roles and responsibilities within the sector.

- 2- The draft bylaw of 2008 for the Medical Waste Management has been completed, but final approval by the relevant authorities is still needed.
- 3- The Draft manual for healthcare waste management in Ramallah Government Hospital is comprehensive, and can be used at a larger scale.
- 4- Awareness and segregation efforts are to be improved within the service provider facilities.
- 5- Although autoclaving was recommended within the master plan, but the plan itself is not finalized yet and remained as a draft.
- 6- Definitions and types of waste are not dealt with within this report as all were previously defined in other approved reports by the MOH, i.e. the draft bylaw and the master plan.
- 7- It was made clear that all Primary Health Care Centers (PHCC) uses sharp boxes/ containers (plastic), and sharps are segregated.
- 8- Part of the generated waste in hospitals is treated, but in smaller facilities no primary treatment was recorded. In some cases, sharps are autoclaved before disposal.
- 9- No official records of the HCW composition were made available to the consultant. At this stage this might not be important, but if other treatment options like incineration were considered, the type of plastic being used is important as it can affect the amount of dioxins emissions.
- 10- The proposed autoclaving as a solution was not subject to an environmental assessment as EQA does not request so and requires only environmental approval.
- 11- A number of training courses were offered to the staff within the MOH, but no recorded reports on the training of those within the private sector.

1.2 Purposes of the Assignment

Recognizing the above, and given the budget allocation by the UNDP (about \$250,000) for the extension of the ongoing project, it was decided to go into the preparation of the feasibility study to examine the possible extension of the scope of work of the ongoing Medical Waste Management Project to cover all service area of Ramallah, Bitunia and Al Bireh Municipalities.

1.3 Tasks and Responsibilities

Under the overall supervision of the Project Manager, and in close cooperation with the two Project Coordinators and the Project counterparts, the consultant will prepare a feasibility study for the extension of the scope of work of the ongoing Medical Waste Management Project to cover all service area of Ramallah, Betonia

and Al Bireh Municipalities. The study should identify basic needed activities and prioritize them. This will be achieved by:

- Meeting with all the projects counterparts.
- Review all relevant documents, i.e. Draft Medical Waste Management Master Plan and Bylaws, Medical Waste Management Project Document and other project-related documents.
- Prepare the feasibility report.
- Suggest a waste reduction/minimization plan for the area under study.
- Discuss the outcomes with the project staff, relevant project counterparts and others in a workshop that will be organized by the UNDP and revise the feasibility study taking all the comments into account.

1.4 Expected Deliverables:

- 1- A feasibility study report covering:
 1. Recommendations that indicates whether extending the scope of work of the project is viable or not.
 2. Definition of intended outcomes and cost- benefits analysis that is associated with extending the scope of work of the project.
 3. Economic and financial viability.
 4. Operating requirements including equipments needed for collection, transport and treatment of medical waste.
 5. An action plan for implementation showing the sequence of implementation and the correlated cost
 6. Regulations and environmental issues.
 - a. In case the extension of the scope of work requires more funds than those available by the project, the Consultant has to present a first phase action plan for the available budget.
 7. Suggestion of a waste reduction/ minimization plan for the study area.
 8. A workshop where the study is presented and discussed.

2. Work Methodology:

To be able to reach the above deliverables successfully, cooperation of those involved in the sector as well as a careful review of available literature is essential. Given the above, the consultant has gone through the following tasks and procedures:

- 1- A kick of meeting representing the official starting of the tasks, with the following outcomes being achieved:
 - a. Official identification of stakeholders, focal points and counterparts: presented in the meeting were the representatives of the UNDP, Ramallah municipality, Ministry of Health, Ministry of Local Governments and Environmental Quality Authority
 - b. Presentation of the work schedules, some comments were made from participants on the tasks as some presented were canceled.

- c. Submission of a request by the consultant to receive all data and information already available with the program team.
 - d. Handing over by the program team of any available reports that the consultant should pay attention to.
- 2- Completion of data and information collection from the stakeholders and other sources including:
 - a. Preparation of list of data and information gap to be collected with a time schedule: including geographic distribution of waste generators and quantities.
 - b. Met with all stakeholders including: Project manager, UNDP, Ramallah Hospital focal point, Ramallah Municipality, Al Bireh Municipality, Bitunia Municipality, EQA, MOH and MOLG, Regional Joint Service Council and the consultant who has prepared the draft manual.
- 3- Site visits were made. This has included main waste generators, proposed autoclave location and possible containers location within the three cities.
- 4- Hold the agreed upon workshop in Ramallah with related stakeholders attending, collect comments and insert responses or clarifications within the report.
- 5- Submit the final report.

Throughout the meetings and literature review, the following was discussed:

- Stakeholders vision on extension,
- Availability of data including validation of accuracy of information,
- Institutional and other technical requirements for the extension,
- Discussion of possible technical scenarios and options for the storage, collection, transportation and disposal,
- Financial resources needed for the expansion of the HCW treatment to the private sectors and the expected costs to run the system.

3. Limitations of the Report:

- 1- As no field data, in terms of HCW amounts, except for the ones collected by UNDP, and composition was directly collected and limited information was available on private health services providers waste generated quantities, and based on the fact that the Regional Joint Service Council (RJSC) has no clear idea on the possibility of including a medical waste cell within the Ramallah landfill site, the report is made on a number of assumptions, some might require further investigations in the future. Those include quantities of waste generated, expected number of beds within private facilities, final management structure of the private facilities waste generation management system,
- 2- With the segregation practices now, it is assumed that with increase

awareness and the placement and implementation of the new procedures, awareness will increase and segregation will improve all the time.

- 3- With the current dependence on donor's assistances in health services supplies, it is assumed that the MOH has limited control on the use or expanded use of disposable material in the future. The increase or decrease of the usage of such material might affect the waste generation rate rapidly or reduce the possibility of the adaptation of a minimization plan.

4. Basic Findings from above Meetings:

- 1- A number of incomplete efforts were made so far to solve the health care waste problem in the study area. This has led to confusions in the available figures and information on HCW.
- 2- The proposed system considers expansion in the scope of work to cover the three cities of Ramallah, Al Bireh and Bitunia only.
- 3- All met stakeholders recognize the problem and its impact and is supporting the UNDP efforts on the possible extension.
- 4- The concept and feasibility study being completed for the domestic waste within the district by the KFW has not and will not at this stage cover the health care sector and assumes that the UNDP will take care of this sector.
- 5- The Regional Joint Service Council (RJSC) of the governorate has not yet discussed the issue of inclusion of health care waste within the system. Both the Head and Deputy Head of the RJSC expressed interest in the subject but confirmed that more in depth discussion and decisions need to be taken by the council on whether to designate a cell in the planned landfill site for dumping of the treated HCW or even to accept treated HCW in their landfill.
- 6- Non of the stakeholders has a clear and final vision on the possible relation with the private sector. Most of the efforts so far have focused on the handling of the Governmental HCW sector.
- 7- The governmental view point is limited to handling (treating) the waste generated by the governmental bodies only, the hospitals and the five health centers in Rammalh, Al Bireh and Bitunia, while the private sector generated waste can be handled by another track, possibly with the municipality or under the Regional Joint Service Council (RJSC).
- 8- The RJSC has no objection in handling the health care waste at some stage but has no clear idea yet on procedures or requirements or required institutional or technical requirements.
- 9- Accepting the HCW, either treated or not, at the proposed new landfill for Ramallah Governorate, requires the RJSC council decision.
- 10- All stakeholders recognize the need to further validate the available data and to improve the data collection system.
- 11- The possible inclusion of the private sector waste generators requires a number of institutional and technical steps which might delay the implementation of the system in the short term but will have positive impact on the long term as accurate field data can be collected.
- 12- A unified tariff system for the study area should be drafted for the private sector waste collection and treatment/ disposal once a final decision has been made on the collection and treatment mechanisms.

5. Selection of Extension Systems, Assumptions and Technical Options:

Given the outcomes of the discussions with the MOH, and their interest to build a system that covers the governmental health service provider's waste generated within the three cities as a pilot aiming at covering the entire West Bank and Gaza at some stage, and keeping in mind that some other donors have shown interest in supporting the sector, it was decided to include the waste generated by the private sector within the three cities as a pilot, but with a stand alone system in terms of operational procedures with a supervisory role including inspection, monitoring and documentation being made by the official bodies. With this, dual system shall be in place; one component for the governmental HCW and the other for HCW generated by non governmental health service providers (private sector). Still, management is to be separate and upper supervision and monitoring is left to the EQA and EHD (Environmental Health Department) of the Ministry of Health as outlined in the draft bylaw of 2008 and the master plan.

5.1 System One: Extension to Cover the Private Sector Waste Generated in the Three Cities:

The definition of the private sector providers is still to be clearly defined, as many clinics have not got the proper licensing from the MOH and could be problematic, and the Ministry is to decide on their inclusion or not. In addition, it was not clear at this stage if UNRWA related facilities are to be included, quantities given in the report does not cover their clinics or activities, yet, the possibility to include them is still valid, and it might not affect the system at any stage.

5.1.1 Waste Generators: Among those governmental and non governmental health service providers, the draft bylaw has listed at least 24 types including primary and secondary service providers, among those, at least 14 types of private service providers can be listed. An example of these facilities can be:

- Private Hospitals,
- Private Clinics,
- Educational and research facilities,
- Laboratories
- Veterinary clinics,
- Pharmaceutical industries, including pharmacies,
- UNRWA related health facilities,
- Red Crescent facilities,
- Zakat Committees Facilities,
- Civil Society Health Care Centers.
- Other providers.

5.1.2 Geographic distribution:

It has been found that the health service providers of the private sector are spread all over the coverage area within the three cities. However, the majority are found in Ramallah City where the main concentration is within a number of areas including Irsal Street, main Ramallah-Al Bireh road, Al Sahel, Al Mughtarebeen, Polos Saba, and Al Nahda Streets as can be seen in Map 1.

5.1.3 Waste Quantities:

The Palestinian Central Bureau of Statistics (PCBS) has some figures on the HCW being generated by the private sector per area only; West Bank and Gaza. No figures were available on different governorates. It can be understood from the PCBS figures and information that:

- 51% of private facilities uses the public containers while 35% use their own containers and 13% uses no containers,
- 70% of the private facilities depend on the local authorities for waste transportation, 15% have their own facilities and 13% have other private arrangements,

The Desk Study on the Environment in the Occupied Palestinian Territories by UNEP in 2003 used the figures generated by ARIJ of 1995 stating that 330 tons of contagious waste, 65 tons of biological waste and 2 tons of sharps are generated each year in the West Bank.

According to the MOH, there are 7 private hospitals with 147 hospital beds (Table 1) in use now. However, an estimate of 16% increase, similar to that of the MOH for the year 2015, the total hospital beds will reach 167 hospital bed, and given a generation rate of 1.26 kg/bed/day, similar to that of the MOH hospitals, then the HCW generated per day in these 7 hospitals is 185.2 kg/day of segregated waste in 2008 or an equivalent to 1426 L/day.

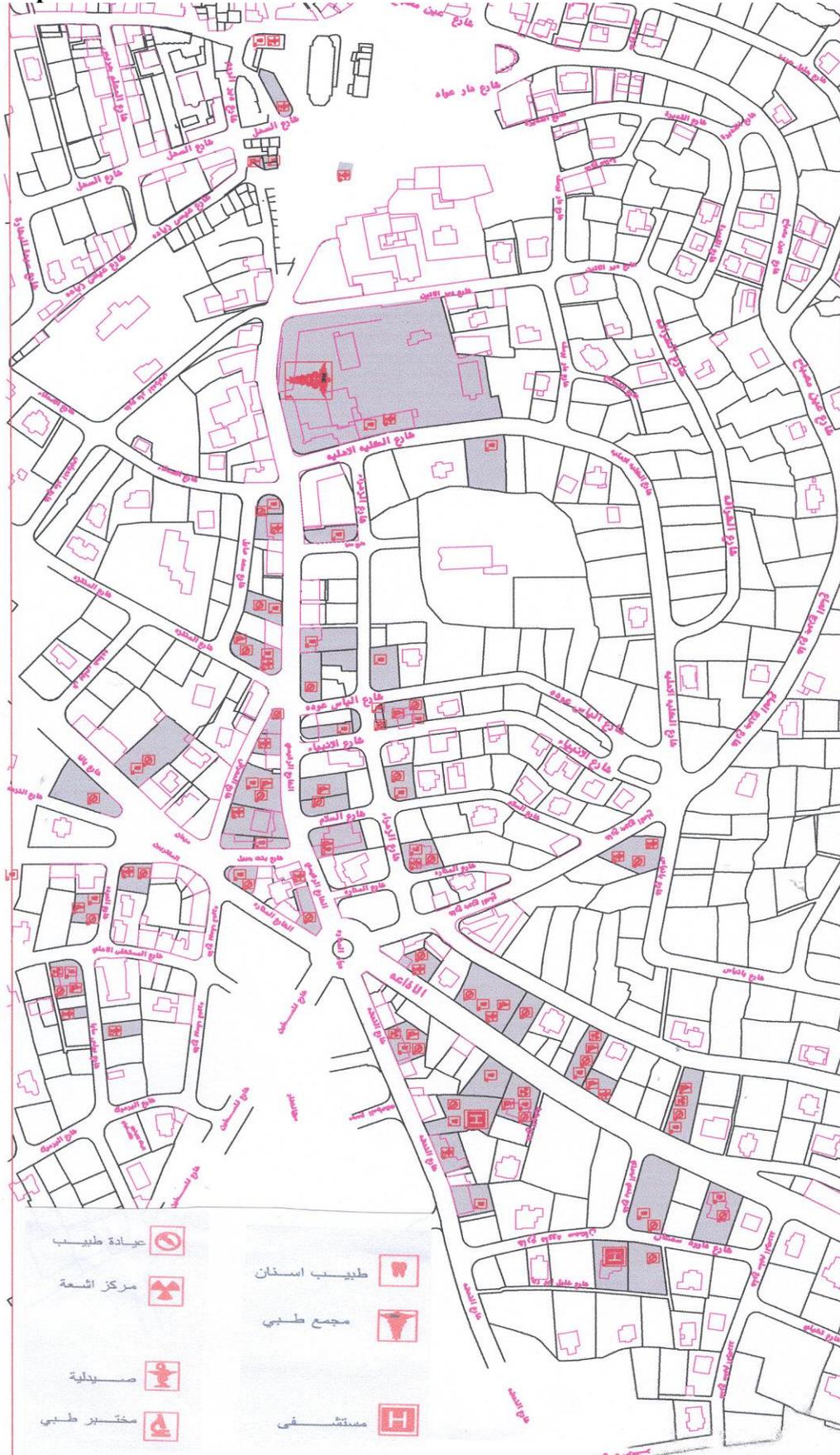
Table 1: Private Hospitals in Ramallah, Bitunia and Al Bireh

No	Name of Hospital	No of Beds 2008	kg/day of HCW
1	Arabi Care Hospital	33	41.6
2	Future Hospital	20	25.2
3	Walid Al Nather Hospital	10	12.6
4	Abu Raya Hospital	27	34.0
5	Red Crescent Society Hospital	33	41.6
6	Khalid Hospital	14	17.6
7	Al Razi Hospital	10	12.6
Total		147	185.2

* Note: The average estimated density of HCW was found 130 kg/cubic meter based on three samples collected by the consultant in Bethlehem and Ramallah.

If the given increase is to be considered, then a 16% increase in waste generated is to be considered, with this, the estimated generated quantity in 2015 is 214.8kg/day or 2620 L/day.

Map 1: Location of Private Health Centers in Ramallah



5.1.4 Primary Health Care Facilities Waste Quantities:

Given the records provided by the UNDP and the municipalities of Ramallah, Bitunia and Al Bireh, the amount of HCW generated is shown in Table 2 below.

Table 2: Quantities of waste generated within the private sector facilities based on UNDP Survey:

	Type of Facility	Ramallah	Al Bireh	Bitunia	Totals	Liter/day	Total waste
1	Private Clinic	146	27		173	63	10,899
2	Health center	8	1	4	13	189	2457
3	Dental lab	8	1		9	63	567
4	Dental clinic	55	21		76	63	4788
5	beauty treat.	7	0		7	63	441
6	Med.lab	15	5		20	63	1260
7	physiotherapy	5	0		5	63	315
8	pharmacies	29	31	8	68	63	4284
Total							25011

Given that 15% is considered as hazardous waste, then 3,751 liters of medical waste is to be treated daily.

As all units were considered in kg, and as no official density was given, the estimated density of 130 kg/cubic meter will be considered, then the amount of HCW generated on daily bases is 487.2 kg.

With the hospitals waste as 214.8 kg per day, then the total HCW generated by the private sector on daily basis is 702 kg/day or 5,505.4 L/day. In other words a total amount of 21 tons of HCW will be generated monthly.

5.1.5 Primary Collection Possibilities for the HCW of the Private Sector

Given the nature of the private sector HC service in the three towns of Ramallah, Al Bireh and Bitunia where most of these services are located in Ramallah, one can consider three different possible scenarios for the HCW primary collection. These are:

- 1- **Central Containers:** Within this system, a number of protected, covered waste containers that fulfills at least the WHO guidelines for such service are to be placed within the three cities where providers can keep container's keys, and bring in the waste on daily basis. The number of containers is based on the number and generation possibilities in each city. Given this, two containers are suggested for Bitunia, four for Al Bireh and eight for Ramallah city. The volume of such containers should not exceed 1000L as they become more difficult to handle and would require more space that is hard to find in any case in the towns of the study area. The filled containers then are collected and the boxes inside are again separated to monitor and fill the data given on each box in a central computer facility. Given the fact of the traffic density and the narrow nature of the roads in the three towns, it will be very difficult to secure safe places to install the

central containers. In addition, it will be difficult to control and protect such containers as no reliable control system can be secured to insure that only HCW is dumped inside and to avoid vandalism. In addition no recording system can be applied to record the daily amounts per generator.

The collection of such containers will require a truck (van) with an enclosed body and a tail lift. (A tail lift is a platform that moves up and down between the ground and the floor of the box body of the truck. This is used for loading and unloading the containers). Another option will be to use a hook lift truck like the ones used for collecting the domestic waste. This gives the advantage that most of the time the truck can be used for other purposes, since it will be used for limited trips each week to collect the HCW. However, this kind of trucks poses more risks of loading and unloading and would require an experienced driver to operate the hook-lift to avoid collision of the containers with the ground or with the body of the truck during the loading and unloading.

- 2- **Door to Door Collection:** This second option would be to use a closed van specially equipped for the purpose of collecting HCW, in bags or small boxes, from the private sector on a regular bases. This collection system would be the best system in theory. However, as many of the private clinics are not officially fulfilling the licensing requirements, mainly from the MOH and also many of these clinics are open on part time bases, mainly in the afternoons, it would be impossible to efficiently collect their waste. In addition, most of these clinics have only one doctor working there and could be difficult for him to bring the HCW to the collection van on due time, especially when he is busy treating some of his patients. Moreover this system would require enormous collection time and one vehicle will not be able to collect all the HCW on daily bases in one working shift. This would tremendously increase the collection cost. However, it would be expected that the same vehicle works for two shifts per day to double the working hours. This would only double the operational costs.
- 3- **HCW Generator Transport to Central Treatment Facility (Own Responsibility):** This system would be based on the idea that every HCW generator will bring his own waste to the premises of the central treatment facility. In this case all HCW produced by the non governmental clinics and health centers will be brought according to a previously prepared plan to this unit. At this unit the HCW will be received for a proper treatment and the generator of the waste would fill a special form to certify his compliance with the procedures of such collection and disposal. In addition the HCW generator will receive the required bags and sharp boxes for the next round of collection. In addition this can serve as a mechanism to collect accurate data for future expansion and improvement of the service besides allowing the MOH to control the proper licensing system for

all HC service providers. This system would require special training for the doctors and workers in the health care centers in order to be able to handle the HCW properly. This might be essential in all cases as the waste generators would be required to segregate and properly mark there HCW at source according to the procedures set in the HCW Manual before finally disposing it to any system adopted. This system will help promoting the awareness of handling the HCW and the ownership among the HCW generators. It would also save tremendous investment for the institution who will be responsible to manage this service and will make the fees imposed on the HCW generators very low as they will carry the costs of collection and transportation. This option will make tremendous savings in terms of investment in the collection and also can help building a very accurate data base on the health care amounts generated by the private sector. However, this option might be faced with objection from the part of the HCW generators as they will be reluctant to take the responsibility of transporting there waste and also could have more potential risks of accidents. But overall, we think it is the most appropriate option at least at this stage.

Summary of these three HCW collection systems options is shown in Table 3 below.

Table 3: Summary of HCW collection options:

Option	Central Containers	Door to Door	Own Responsibility
advantages	1- Easy to collect by the vehicle	1- ensures that all waste is collected 2- empty bags and sharp boxes can be handed over 3- proper registration and recording	1- less cost on the system 2- empty bags and sharp boxes can be handed over 3- proper registration and recording
Disadvantages	1- lack of supervision 2- no recording system can be applied 3- possibilities of theft, vandalism and damages	1- Timing might not be acceptable . 2- More risks of accidents during the collection	1- irresponsible generators might look for other easier options
Requirements	1- Finding proper locations	1- registration of all generators 2- ensure that all are licensed	1-proper educational/ awareness program
Capital and operational Cost	1- cost of Containers 2- cost of vehicle 3- driver's salary 4- vehicle operation	1- cost of vehicle 2- Driver's salary 3- Waste collector's salary	All collection costs are paid by generators
Recommendation	Although central containers are favorable still, the own transportation system is recommended if recording and monitoring is required		

From above systems, and given the advantages and disadvantages of each option, the consultant recommends the own responsibility collection option to the treatment facility.

However, there might not be one perfect solution that can fulfill the stakeholders

ambitions and current capabilities on the one hand, and that still to be completed in terms of institutional and logistic requirements. Based on this, a phasing approach might be helpful at this stage. The framework for the phasing would include the three municipalities of Ramallah, Al Bireh and Bitunia agree on a Memorandum of Understandings (MOU) to cover the following areas:

- 1) Start first with the handling of the HCW generated by the private hospitals and the health care centers.
- 2) To handle the medical waste service jointly through a specialized unit. This means collection, transportation, treatment and final disposal to landfill sites.
- 3) Agreement on unified fees for collection, treatment and disposal,
- 4) Sitting of the treatment, responsibility of each partner and ownership of the equipments and other fixed assets.
- 5) Start putting the arrangements for the future left out of the smaller facilities like the private clinics, etc.

Having agreed o the above mentioned MOU, the three municipalities can proceed with the handling of the HCW in stages as follows: This could be done as follows:

Stage 1: In this stage the waste containers will be purchased and distributed to the private hospitals and the health care centers. These containers should be designed in a way to allow easy and comfortable filling and emptying the waste into and out of the containers without damaging the labeled bags or create serious difficulties for the workers.

Each of the hospitals and the health care centers would be required to establish its own internal management system to collect properly and according to the bylaw of 2008 their HCW and bring it to their central container.

The municipal health care waste management unit would then send their vehicle on a regular time frame to pick up these containers and bring them to the central treatment unit. The same vehicle will bring a clean and empty container to each facility prior to taking off the loaded containers or simultaneously.

Stage 2: This stage will expand the first phase to include the other smaller health care facilities, and the private ones. Within this phase, the service area is divided into zones in which all the health service providers will be identified clearly. These zones will help the municipalities to decide on the work force needed for the collection and plan the frequency time for collection.

Although a recommendation was made above on own responsibility transportation option, a joint decision can still be made through sharing the discussion with the private facilities owners. This can be made either within a meeting and options can be outlined and based on the discussion outcomes, a decision is made, or through a questionnaire where options are outlined and each is asked to put his own recommendations. Yet the first option of the joint meeting is still recommended.

Within the meeting above final recommended options for collection, transportation and management can be farther discussed and approved.

Stage 3: Within this stage a farther expansions can be made to cover the rest of the governorate if appears to be needed.

5.1.6 Transportation options:

The bylaw of 2008 for the Medical Waste Management states clearly that the stored waste can be left in the storage facility for a maximum of 48 hours. However, the PCBS has indicated different storage timings as follows:

- 50% only of the secondary treatment facilities collect and transport the waste on a daily basis, 32% collect 4-6 times a week and 14% collect 1-3 times a week
- within the PHCC, 61% collect 1-3 times a week, 32% on 4-6 times a week, and only 6% on a daily basis

With this, shifting to daily or every other day collection and transportation requires a lot of effort on the awareness and educational front.

Still, with the above collection scenarios, requires different transportation options as follows:

a- Central Containers: A collection truck, as discussed above, is proposed for the private facilities waste generated. Depending on the given quantities, the private sector truck is proposed to collect the waste from the containers three times a week. The given collection vehicle specifications are still valid and all the central containers should fulfill at least the WHO specifications for such service.

b- Door to Door Collection: the collection vehicle (van) is proposed to collect the HCW generated by each health care facility three times a week and to take the waste to the central treatment facility. It should be designed internally to carry as much as possible of the collected HCW which will come in specially designated bags and boxes.

c- HCW Generator Transport to Central Treatment facility (Own Responsibility): for this option, no further transportation is required as all waste will be transported by the generators to the central treatment facility every other day.

5.1.7 Treatment and Final Disposal Options

Looking into the treatment options in place within the private sector today, and as shown within the PCBS, the following were listed without classification:

- 47.6 % depends on disinfection,
- 15% on open burning,
- 13.4% on mechanical treatment,
- 13.4% disposal into sink, and
- 10.5% on other methods.

The alarming situation is that 9.6% of the private sector waste generators do not know where the waste is disposed of, while 84.9% know it is the job of the local authorities and 5.6% know that it is treated, but do not know how or where.

Technically, there is a wide range of technical options that can be used for the treatment of healthcare waste. This includes, but not limited to, the following:

- Incineration,
- Central autoclaving,
- Autoclaving at point of generation,
- Land filling,
- Microwave, and,
- Chemical Disinfection

The advantages and disadvantages of the different treatment options are shown in Table 4 below.

Table 4: Comparison of the Advantages and Disadvantages of the different Treatment Options

Treatment option	Advantages	Disadvantages	Numbers required based on the estimated quantities
Incineration	<u>Elimination of health risks: destroys micro – organisms</u> <u>Reduces volumes and mass of HCW</u> <u>Heat recovery is possible</u> <u>Large quantities can be treated</u> <u>Waste is not recoverable</u>	<ul style="list-style-type: none"> - High investment cost - Requires technical skills - Close monitoring is required - High operation costs - Toxic emissions - Residue still needs safe disposal 	- One central unit
Central Autoclaving	Simple operation process Reasonable investment cost Reasonable operational costs Easily understood technology Minimal emissions Variety of options Environmental sound technology Can not treat all kinds of HCW	Waste water treatment is required Still requires land filling No reduction in size, volume or mass Waste can be recognized after autoclaving. Can not treat pharmaceutical waste	One central unit
Autoclaving at source of generation	Less storage capacities are required Less transportation is required Less effects of breakdowns Less effects of closures or road blocks Environmental sound technology	Waste can still be recognized after treatment More efforts in monitoring Increases investment costs if compared to central autoclaving No volume reduction	At least 4 units
Land filling	No capital investment if done within an operational landfill Waste picking is controlled No need for segregation, except for sharps	No treatment leaves space for potential infections High level of coordination is required at the collection and disposal points Potentially long	One landfill

		transportation distances to landfill leaves a space for emergencies preparedness Special arrangements are required at the landfill for protection	
Microwave or radio wave (disinfection)	Shredding reduces waste volume No air pollution Can be sent directly to landfill	Relatively expensive to install High operation and maintenance costs Pharmaceuticals can not be treated Requires special packaging Generate contaminated wastewater	At source, in each large facility
Chemical disinfection	Shredding reduces volumes	Land filling is still required Cannot be used to treat pharmaceuticals Skilled operators are needed Expensive to operate and maintain Generates hazardous waste water	At source, within each large facility

Some of the above listed options were tested locally including the incineration; a number of incinerators were provided by the Government of Spain to a number of hospitals. However some of these incinerators were never installed, and those put into services faced a number of technical and social problems including concentrations of the emissions, due to incomplete chimneys and filters set up, the lack of know how to operate them, as well as the installation locations.

Despite the fact that there are different treatment options for the HCW, the " Draft Master Plan for Healthcare Waste Management for the West Bank and Gaza, 2005", has identified that the autoclaving option as the most suitable option for HCW treatment in Palestine. This should not eliminate the current in house primary treatment of infectious wastes.

Given the above, the consultant suggests a central autoclaving for the three cities waste generated by the private sector. It can be installed for the short time within the premises of Ramallah Municipal facilities near the current dumping site of the municipality. In the long term, a new facility location could be decided among the municipal stakeholders of the RJSC. Within this short term system, an autoclave is to be installed, operated and managed under the supervision of the municipality of Ramallah unless otherwise is decided. However under the current plans, serve Ramallah, Bitunia and Al Bireh Municipal areas, potential risks remain for the HCW generated at the rest of Ramallah Governorate communities if not handled properly. Since the RJSC was established to serve the whole governorate and will play a role in the handling of the HCW, no matter which option is selected, it might be wise to

reconsider expansion the scope of work to cover Ramallah Governorate as a whole. If this decision is made, then it would be wise to consider handling the responsibility of the HCW collection, treatment and disposal to the RJSC as this will build the capacity of the RJSC and centralize the service.

It is worth mentioning that the Autoclaving could be coupled with Mechanical grinding devices (Shredders) which are sometimes introduced prior to treatment, during treatment, and/or at the end of the treatment process. A few facilities insist on shredding the health care waste either as a matter of preference or because they falsely believe that their liability will somehow be limited. Some technologies, however, depend upon shredding as an integral part of the treatment process, i.e., those systems that shred prior to treatment and during treatment. However it is worth mentioning that Shredders are typically a high maintenance item due to unavoidable volumes of trapped waste in the waste stream such as high quality stainless steel found in orthopedic blades, drills, reamers, and prosthetic devices. Glass is also inherent in the health care waste and over time, glass wears the cutting surfaces of the shredder blades. Therefore, if the facility intends to shred waste either pre- or post-treatment, anticipate that rigorous maintenance schedule with associated cost would be required. Shredding the waste simply to render it unrecognizable makes the task more burdensome and more expensive than necessary and a cost benefit analysis should be conducted prior to making that decision. Also, consider the potential down time when the shredder is out of commission with those technologies that depend on shredding. The consultant is not in favor of shredding. However, the final decision remains for the stakeholders.

Final Disposal Options:

Regardless of the selected technology, most treatment options leaves behind waste which is still to be dealt with, some is hazardous like the incineration ashes.

Autoclaving of HCW leaves behind the same quantities which should be disposed off finally. Limited options are possible, these include:

- Open burning (currently 15% is burnt), which is not at all recommended,
- Use of current disposal sites; Ramallah or Al Bireh. These are the available options for the time being. Al Bireh site might require special arrangements with the Israeli site, so temporary "storage" within the Ramallah dumping site remains the only feasible option for the time being. With this option, waste should be buried in defined locations with the possibility of future removal once the regional sanitary landfill of Ramallah Governorate is built and operated.
- Disposal at an Israeli managed site like Abu Dies, this is still possible with some arrangements with the Israeli side, but the cost might be beyond the capabilities of the generators.
- Disposal at other Palestinian sites like Zahret Al Finjan in Jennin, but non is within a logical driving distance from the city centers.

Regardless of the decision made, the final disposal in the long term is proposed to be within the proposed Ramallah Governorate landfill site once built and operated given that the RJSC has agreed to build a separate cell to receive the partially or treated health care waste. The final transport from the treatment unit to the dumping site will be handled with the normal municipal solid waste collection trucks.

5.1.8 Institutional Requirements for the Private Health Sector:

The master plan has outlined the management structure within the governmental sector, as for the private sector health care waste management system, stakeholders can agree on a structure which can temporarily be at this stage under the supervision of Ramallah municipality. Later on, a management system is expected to be in place under the direct supervision of the RJSC. Both are still under the upper supervision of the Environmental Quality Authority (EQA), and partial under the environmental health department of the Ministry of Health in accordance with the draft bylaw and the master plan. This still will require further discussion and investigation as the stakeholders did not decide yet among themselves on the final management structure of the private HCW.

5.1.9. Financial Aspects:

Capital Investment Expectations: Given the three systems mentioned above and the Autoclave Capacity given in liters, the capital investment costs per collection system are given below:

a- Central Containers:

A- **Capital Costs:** The capital investment needed for this option is shown in Table 5 below.

Table 5: Capital Investment Needed for Central Containers Option

	Item	No. of items	Cost per item, USD	Total cost (USD)
1	Storage containers	14	1500	21,000
2	Autoclave containers	2	7,500	15,000
3	Autoclave (1105 L capacity)	1	95,000	95,000
4	Vehicle	1	100,000	100,000
	Totals			231,000

B- **Operation Cost:** within this system, the main operation cost items shall be the manpower, fuel, sharp boxes and plastic bags. If the waste generator is to bear the cost of the last two items, then the other components are:

- a. Two persons to operate the autoclave system, a driver and a waste collector and a supervisor. If average wages are considered of \$1200 USD per month, then \$ 6,000 USD is to be allocated.
- b. Given the current fuel cost in the area, \$2,500 USD is to be allocated per month for the vehicle.
- c. Final disposal fee is dependant on the final disposal scenario. If the proposed Ramallah landfill site is decided, which is recommended, then the RJSC is to decide upon the disposal fee. However, general tipping fee at Zahret Al Finjan is \$10/Ton. Similar fees can be assumed for the treated HCW. This means the monthly tipping fee of the treated HCW will be

\$210.

Given the above mentioned figures for investment and operation, a total investment of \$ 335,520 USD is required for the first year.

b- Door to Door System: For this system there will be no need for the storage containers. The rest remains as the Central Containers System.

A- Capital Costs: The capital investment needed for this option is given in Table 6 below.

Table 6: Capital Investment Needed for the Door to Door Collection Option

	item	No. of items	Cost per items, USD	Total cost
1	Autoclave containers	2	7,500	15,000
2	Autoclave (1105 L capacity)	1	95,000	95,000
3	Vehicle	1	70,000	70,000
Totals				180,000

C- Operation Cost:

Within this system, the main operation cost items shall be the manpower, fuel, sharp boxes and plastic bags. If the waste generator is to bear the cost of the last two items, then the other components are:

- a. Two persons to operate the autoclave system, a driver and a waste collector, a supervisor; if a minimum wages are considered of \$1200 USD per month, then \$ 6,000 USD is to be allocated
- b. Given the current fuel cost in the area, \$2,500 USD is to be allocated per month.
- c. Final disposal fee is dependant on the final disposal scenario, if the proposed Ramallah landfill site is decided, which is recommended, then the JSC is to decide upon the disposal fee. An amount of \$10/Ton would be relevant. Therefore a total tipping fee of \$210 USD will be needed monthly.

With this, and including the system operator and collection in two shifts daily, an investment of \$ 386,520 USD is required for the first year.

c- HCW Generator Transport to Central Treatment facility (Own Responsibility): For this system the following costs will be needed:

A-Capital Costs: This option does not require vehicles or central containers for collection. The capital investment needed for this option is given in Table 7 below.

Table 7: Capital Investment for Own Responsibility Option

	item	No. of items	Cost per items, USD	Total cost
2	Autoclave (1105 L capacity)	1	95,000	95,000
3	Autoclave containers	2	7500	15,000
	TOTALS			110,000

B- Operation Cost: within this system, the main operation cost items shall be the manpower, sharp boxes and plastic bags. If the waste generator is to bear the cost of the last two items, then the other components are:

- d. Two persons to operate the autoclave system, one assistant and a supervisor will be needed to operate this system. If a minimum wages are considered of \$1200 USD per month, then \$ 4,800 USD is to be allocated.
- e. Final disposal fee is dependant on the final disposal scenario, if the proposed Ramallah landfill site is decided, which is recommended, then the RJSC is to decide upon the disposal fee. However, if \$10/Ton is collected as a dumping fee, then a total amount of \$210 USD will be needed monthly.

Given the above mentioned figures for investment and operation, a total investment of \$ 170,120 USD is required for the first year.

Given these three systems, Table 8 below summarizes the expected Capita investment per system

Table 8: Summary of the Capital Investment for the Different Options

System	Equipment Cost	Monthly Cost (Manpower and dumping fees)	Total Investment for the First Year
Central Containers	231,000	8,710	335,520
Door to Door	180,000	17,210	386,520
Own Responsibility	110,000	5,010	170,120

Given the current conditions in Palestine, it is expected that the capital investment needed for efficient handling of the Health Care Waste will be paid by one of the donor agencies. This would include a maintenance contract for at least 3 years. However, there is still a need to set up a realistic fee for HCW collection and treatment that covers the operation and maintenance costs and to keep in mind the possibility to allow for cost recovery.

Since all collection fess for solid waste are collected by the municipalities, it is recommended that collection of fees remains the responsibility of the municipalities and should be based on the polluter pays principal, i.e. the amount charged will be dependent on the volume of registered waste collected.

Given the above mentioned costs for the different systems and the estimated amount of HCW generated of 21 Tons/month, the minimum fee need to be collected monthly is given in Table 9 below:

Table 9: Treatment Fess for the different options

System	Monthly Manpower Cost	Tipping Fee \$/Month	Total Monthly Cost (\$)	Monthly Fees \$ USD/Kg **
Central Containers	8,500	210	8,710	0.42
Door to Door	17,000	210	17,210	0.82
Own Responsibility	4,800	210	5,010	0.24

** This is obtained by dividing the total monthly cost by the total monthly collected waste (21,000 kg)

From the table above, it is clear that the own responsibility option is the most feasible one in terms of operational costs. We do recommend to adopt this option which also allows the creation of detailed data bank on the amounts produced by each generator also allows the control of the licensing procedure as more data will become available to the relevant authorities on each generator and to what extent he is following the recommended procedures for handling the HCW as detailed in the bylaw of 2008.

5.1.10 Monthly Operational Costs with Cost Recovery Option:

As the capital cost is donated by the UNDP and no commitment was given to maintain or replace the treatment unit in the future, it is recommended that a cost recovery fee is also added to the monthly fee in terms of a percentage on the cost/kg of treated HCW

The operation cost cover three areas including the waste treatment related operations, the office functions as well as the related staff and personnel cost. The details of these operations and the estimated budget are shown in the attached budget sheet.

As the capital and operations cost is estimated at \$335,520USD for the central containers Option, \$386,520 for the door to door options and at \$170,120 USD for own responsibility option , then the cost recovery shall be based on these estimates and recommendations shall be made at a later stage.

If the capital investment cost is to be collected back over the next 10 years (as was proposed by other waste programs being implemented locally), then the cost recovery rates will be as shown in Table 10 below:

Table 10: Cost Recovery Rates

	Central Containers Option (USD)	Door to Door Option	Own Responsibility Option (USD)
Capital investment	231,000	180,000	110,000
To be collected on yearly basis	23,100	18,000	11,000
Operations/year	104,520	206,520	60,120
Cost /kg	0.51	0.89	0.28

The above calculations are based on 702 kg/day or 21,000kg/month and on equipment cost recovery within 10 years. From these calculations it is very clear that the own responsibility option is the most feasible one in terms of costs needed for operation and for cost recovery while the door to door option is the most expensive one.

If capital investment cost recovery is made over different periods, then cost per kg is changed.

5.1.11 Current Municipal Fees Collection:

Based on the figures provided by the three municipalities, it was clear that non of them has any type of fees specifically for the collection of the HCW. They only have fees for the domestic solid waste and they do not share the same fee structure or the collection system. While some has defined the waste providers into a number of categories, others has limited that to only few.

The current fees collected from related institutions as recorded by the municipalities are shown in Table 13. It is very clear that there is no unified systematic system to determine the fees and every municipality has its own adopted structure. Most of the time like in the Bitunia municipality the fees are charged as domestic waste without any differentiation between the waste generators.

Table 13: Current Sanitary Fees Collected by the three different Municipalities

Institution	Ramallah Municipality	Al Bireh Municipality	Bitunia Municipality
	Sanitary Fees JD/Year		
Pharmacists	120	68 or 150	60
Pharmaceutical warehouses	180		
Dental laboratories	60		
Pharmaceutical industries	360		100-400
Medical laboratories	60		
Private clinics	12JD/16m	68	
Private hospitals		150	

The above fees are not based on a systematic tariff system but were assumed by the different municipalities despite the fact that all agree that the fees are not enough to cover the costs of the solid waste service. In addition all the three municipalities suffer from the very low collection percentage rates of the fees. The status of fees collection requires an action on the ground in terms of "actions to be taken" if the waste generators refuses to pay the required fees.

5.1.12 Cost Benefit Analysis and Economic – Financial Viability

Due to the fact that this project is directed towards a serious environmental threat i.e. the treatment of hazardous medical waste that are threatening the environment and the public health in general it is clear that it's benefits are enormous and it is hard to quantify the overall benefits from such a project. On the other hand the operation of the proposed project will generate some cash-flow which is worth to analyze and assess against the initial capital investment and the operational cost.

First, it was found out that the fees charged from processing and treating the hazardous waste every month will be the only source of cash flow; so a simple breakeven price was calculated according to each scenario.

The cost benefit analysis as shown in Table 14 and Table 15 below demonstrates the CBA for the two scenarios of investment. The first scenario is assuming the initial investment is not donated and the second scenario assuming the initial investment is donated by a donor. The CBA will be conducted while assuming the following:

1. There is no increase in amount of waste collected during the upcoming 10 years which is 21 tons per month.
2. There is no interruption of collection operation.
3. There is no increase in Salaries and in operational costs for the coming 10 years.
4. Assuming that the charged fee will be the same for the coming 10 years
5. 5% interest rate is assumed to be constant during the 10 years of the project

Table 14: The initial investment is Not Donated

System	Initial Investment	Annual Operational Cost	Total breakeven price per KG	annual fees collected	PVB	PVC	NPV (PVB-PCV)	BCR (PVB/PCV)
Central Containers	231,000	104,520	0.51	128,520	1,042,017	1,038,076	3,941.507	0.38%
Door to Door	180,000	206,520	0.89	224,280	1,818,422	1,774,693	4,3729.55	2.46%
Own Responsibility	110,000	60,120	0.28	70,560	572,087.9	574,230.7	-2,142.81	-0.63%

As noticed from the table above the PVB (present value of benefits) is in two cases higher than the PVC (the present value of costs) and a difference of 2,142 is found in the "own responsibility" scenario.

The first two scenarios seem to have positive BCR (benefit cost ratio) but still have high initial and operational costs in comparison with the third scenario; so this makes the "own responsibility" scenario the most attractive one due to the small amount of investment needed, the low operational costs and not to mention the small fees charged to collect and process the waste.

Case two: the initial investment is donated

If the initial Investment to be donated without any intention to retrieve it back, then there will be excess cash flow that can be used to address increase in operational

costs, maintenance fees for equipment or any other cost center. Still the third scenario will be the most attractive one.

The new figures are in the table below:

Table 15: Cost Benefit Analysis assuming the initial investment is donated by the donors:

System	Initial Investment	Annual Operational Cost	Total breakeven price per KG	annual fees collected	PVB	PVC	NPV (PVB-PCV)	BCR (PVB/PCV)
Central Containers	231,000	104,520	0.51	128,520	1,042,017	807,075.73	234,941.51	29.11%
Door to Door	180,000	206,520	0.89	224,280	1,818,422	1,594,692.70	223,729.55	14.03%
Own Responsibility	110,000	60,120	0.28	70,560	572,087.9	464,230.70	107,857.19	23.23%

In both cases; the three scenarios are economically viable and feasible at the same time; covering at least their operational cost, taking into consideration that the waste generated will increase in the foreseen future, it is expected that there will be more demand on the services offered which will result in more cash flow coming from the current operational level.

The cash Flows generated from any of the above mentioned scenarios is expected to cover at least the operational cost assuming stability in collection and operation , where in the second case as mentioned earlier, there will be room to cover any fluctuation in operational cost or any unexpected maintenance costs.

The project and its operations will be financially independent ; which is very important keeping in mind the current fiscal problems storming Palestine ; being self-sustainable in the operational cost can guarantee the continuity and consistency of services offered.

It is recommended that the excess cash generated from any project scenario to be chosen from the second case to be invested in expanding the operations to new health facilities.

Over all it is expected that the direct environmental and indirect economical benefits from implementing the project will exceed its fiscal ones.

5.1.13 Recommendations for the Private Sector Waste Generated:

Based on the 702 kg/day HCW generated and is to be treated, the following is the consultant recommendations for this sector:

Primary Storage:

- Each facility should have their own sharp boxes and plastic bags,
- Waste segregation and Separation is a must.
- Maximum on site storage time is based on the draft bylaw of 2008 (maximum 48 hours) and this should be respected, unless EQA and the MOH has another recommendation.

Transportation:

- Each waste generator is responsible to label the sharp box and plastic bags in accordance with the master plan and the draft bylaw of 2008 recommendations.
- Labels can be obtained from the treatment facility operator.
- Each waste generator shall bring his waste to the treatment facility and make sure that it is recorded at the site.
- Depends on final arrangements, treatment fees can be paid on the site on monthly, quarterly or annual basis. Annual payments with the licensing fee are recommended.

Treatment:

- A central autoclave shall be built to handle all private sector waste generated. In the short term this could be done at the Ramallah Municipal premises near the municipal dumping site.
- If a user brings in any unsorted waste, this shall be recorded, a note shall be sent to him to make sure that waste is segregated.
- Fees could be based on the weight of waste received at the site.
- Collected fees covers both treatment and final disposal fees.

Collected Fees:

- The current estimate for treatment of HCW as indicated above is 0.23 USD/kg for own responsibility collection option and 0.5 USD for central collection option.

If other donors are assumed for the replacement of the system in the future, then the figure will be reduced.

Final Disposal

- For the time being, a temporary burial place shall be used at Ramallah dumping site,
- Once the sanitary landfill for the RJSC is built, all stored waste as well as any new waste shall be transferred to the new site

5.2 System Two: Extension of the system to cover all Governmental Health Providers:

This system is designed for the year 2015 based on the mid term strategy of the Ministry of Health

5.2.1 Waste Generators:

With this scenario, only governmental related facilities are included; this includes five hospitals located within Palestine Medical Complex and 82 primary health care facilities, out of which only the five facilities in the three cities shall be included.

5.2.2 Geographic Distribution:

The 5 hospitals are located in Ramallah and Al Bireh only, no governmental hospitals are located in Bitunia,

5.2.3 Waste Quantities:

Given the expected number of beds in 2015 as 468 hospital beds, and given the HCW generation rate as 1.26 kg/bed/day, the total waste generated per day from governmental hospitals is 589.7 kg compared to only 403.2 kg/day currently based on 320 hospital beds and 1.26 kg of segregated health care waste generated per bed per day.

The PHC facilities considered are 5 main ones in the three cities. The total recorded visitor for the first quarter of 2008 is 14,663 patients while it is 13,388 patients for the second quarter of 2008. Based on these figures, the average recorded monthly visitors are 4,875 patients (according to the Directorate of Health of Ramallah and Al Bireh). With an average of 0.5kg/patient/month is expected, then 81.3 kg of segregated HCW shall be collected on daily basis.

With this, a total of 671 kg of HCW is generated within the Governmental HC facilities on daily basis or 20.13 tons on monthly bases.

5.2.4 Waste Storage:

After collection, all HCW can be stored within the medical facility as outlined in the master plan and in accordance with the stated procedures and conditions. As already known, and outlined in the draft manual prepared by the UNDP for the Ramallah Hospital, rigid boxes are used for sharps holding and storage, and colored (yellow) coded heavy plastic bags. These bags serve also as liners for the medical waste buckets and bins used within the facilities departments.

All storage facilities should be large enough, ventilated, well protected against birds, animals or rain water, and can easily be accessed and cleaned. (complete description of storage facilities including conditions and standards are well illustrated within the master plan).

5.2.5 Collection Possibilities:

Given that waste facilities are provided with HCW containers, designated waste collection vehicle shall collect on daily basis from main facilities temporary storage facilities, i.e. hospitals and four times a week from primary health care facilities. The draft bylaw of 2008 for the Medical Waste Management does not allow for longer storage times unless waste is stored in cold places which might not be available at most health services facilities.

5.2.6 Transportation Options:

The system designated vehicle is proposed to collect the stored waste from the designated containers on daily basis from hospitals and four times a week from the PHC facilities containers. Quantities generated from the Governmental Health Centers

might not justify the daily or weekly collection, but due to the nature of the waste, it is recommended that collection is made on these bases.

5.2.7 Treatment and final disposal options

As autoclaving is the selected treatment system, and it is known that with this system the physical characteristics or the volume of the waste is not changed, then a final disposal system is still required. The recommended disposal system is to have a special cell within the central sanitary landfill to be constructed, meanwhile, the current disposal system of Al Bireh and Ramallah disposal sites are recommended provided that waste is covered immediately to avoid being picked again.

Formal agreements or memorandum of understanding should be signed with the RJSC, this might affect the agreement with the donor in terms of budgets allocations for the landfill project and therefore it should be dealt with immediately.

5.2.8 Institutional requirements:

As already indicated a number of steps are still expected to be completed at the national level as well as at the local level including:

- 1- The finalization and endorsement of the draft bylaw for the year 2008 which addresses the definitions, segregation, color coding, handling procedures and treatment procedures. Meanwhile, the draft manual prepared by UNDP can serve this program.
- 2- A management unit is to be established at the National level with another one at the local level.
- 3- Awareness and education/ training programs on impacts, procedures and emergency response possibilities and actions initiated.
- 4- Monitoring systems by the EQA and MOH should be in place immediately

5.2.9 Cost Related:

a- Capital Costs: Given that land is already available, the other capital costs incurred at this stage are given in Table 11 below:

Table 11: Capital Costs for the Governmental HCW Treatment Facility

	Item	No. of Units	Cost USD**
1	land	NA	00
2	Autoclave Unit (650 L capacity)	1	83,000
3	Containers	3	10,500
4	vehicle	1	75,000
7	Unit Installation		Included
	TOTALS		168,500

** It is expected that these costs will be paid by the program

b- Annual Operational Costs: These costs will mainly cover the costs of the driver, unit operators and the vehicle driver. The total is given in Table 12

Table 12: Annual Operation Costs for the HCW Treatment

	Item	No. of Units	Total Monthly Operational Cost USD	Total Annual Cost USD
1	Driver @ \$1200/month	1	1,200	14,400
2	Unit operator @ \$1200/month	2	2,400	28,800
3	Vehicle operation and maintenance	1	1000	12,000
Total			4,600	55,200

Based on the above mentioned figures and the monthly generated HCW of 20.13 tons, the monthly operational cost excluding the cost recovery is \$0.23/kg. If the cost recovery of the investment is taken for 10 years then the total cost of HCW treatment is \$ 0.3/kg.

It is recommended that above operational costs are paid by the program for the first year, and then the MOH is to cover the operational costs. Discussions should be initiated within the MOH on the forms of coverage of these costs. Discussions with representatives of the MOH showed it is not possible to impose a special fee for the treatment of the HCW generated by the governmental health centers.

Other costs are expected to be covered by the facilities; these include internal management costs, plastic bags, sharp boxes, bins, and workers.

6- Expected Fees Collections and Cost Recovery:

6.1 Affordability:

If the governmental health services fees or cost per services are fixed or decided centrally and given the socio economic conditions in the WBG are as of today, then the central government or the facility itself are to cover the operation cost of the treatment unit. The public cannot afford today paying for new services keeping in mind that the governmental facilities serve mostly the poorest of the communities. Either way, the individual or the public are not to notice or fear the additional operational cost. Still, this should not at all affect the current quality of the services being provided

At the private sector, a fee is to be collected, regardless of claims of business cost and profit being made, services are provided to those who can afford it, and an increase in the fee can still be made. Even with a fixed services fee, the private sector can afford paying for the treatment and disposal fees.

6.2 Cost Recovery Options:

a- Governmental Sector: At the governmental sector, two options are proposed:

- The central government allocates an annual operation cost, this is recommended, the government can add a small amount (should not exceed 5% on the current health insurance policies, or a 5% on the

services fees).

- Each facility finds its own resources; from within collected fees, if any. This option is not recommended as resources are limited and it might affect the quality of operations.

b- Private Sector: At the private sector, the collected fee at the central facility should include the treatment cost, the transportation to the landfill cost as well as the landfill tipping fee.

If a donor is to step in and provide capital support for the replacement of the system in the future, the management team is still to collect the operational fees.

7- Environmental Mitigation Plan:

The EQA does not require any impact assessment for such a project and only requires environmental approval as they consider such project of limited activity.

However, a mitigation plan in place indicating the possible threats, mitigation measures, responsibilities and time frame for actions to be taken with relevant cost per action remains essential.

8- Policy Considerations:

It is legally requested by all health service providers to handle the waste generated during their operations. The bylaw of 2008 for the Medical Waste Management has covered all services providers, regardless of location, ownership or size. All waste types are included and therefore the proposed project is a direct implementation of the said bylaw.

9- Action Plan for Implementation:

Implementation of the required steps to achieve the goals of expansion can be over a number of phases, as shown below, including:

- 1- An Inception/ planning phase where all policy issues are finalized, legal requirements and procedures are completed, implementation plans are approved. During this phase, all non resolved decisions are taken, and uncertain procedures are defined. This requires a number of recommendations to be taken by the Steering Committee and then approved by the cabinet or line ministries. Discussions with the private sector or the RJSC are also recommended during this phase. This phase should not take more than 4 months.
- 2- The Preparatory phase: during this phase, staff are appointed, minimization plans are drafted, awareness programs are drafted, monitoring and evaluation plans are in place and required field data collection system is approved and operational. Draft list of equipment can be initiated during this phase, and sitting of communal containers are completed. Again together with the first phase, above actions are to be completed within the first 5-6 months.

- 3- The implementation phase: all prepared action plans and procedures prepared above are implemented in this phase; the utmost important is the procurement stage which should be completed within the first two months of this phase or during the first 6 months of project initiation. Staff training, equipment installation and education programs are all initiated. Within this month, the monitoring system is operational and the reporting system is functional.

10- Waste Minimization Plan

HCW minimization is a requirement by law and is also outlined in the master plan. A number of procedures are recommended in both documents and can be outlined as this:

- 1- waste segregation at source.
- 2- control the waste generation through:
 - a. reduce use of mercury and use electrical/ digital devices,
 - b. reduce the use of PVC materials especially disposables,
 - c. use low poisonous material for cleaning or disinfection,
 - d. maximize the use of environmental friendly material; card boxes
 - e. keep records,
 - f. restrictions on purchasing requests to ensure the selection of less wasteful materials,
 - g. recycle as much as possible, and whenever possible.

In order to be able to apply a waste minimization plan based on the above, a number of pre requisites should be achieved including:

- Baseline waste generation rates should be identified, this is valid for both governmental and non governmental facilities regardless of type or size of services provided
- Health care facilities operators/ managers or owner within the private sector must be committed to waste minimization for it to be successful and sustainable in the long run.
- As waste minimization is within the national policy, written procedures should be in place with specific goals, objectives, and timeliness as well as achievements indicators.

10.1 Implementation Procedures:

Implementing workable HCW minimization practices should be incorporated into the on-going operations policy directives to staff. The implementation should consider the following:

- a- Planning Stage: within this stage, the following is proposed:
 1. goals are identified,
 2. commitment is secured,
 3. pilot areas are selected.
- b- Assessment stage: within this stage, the following is done:
 1. document waste generation data,

2. put in place the recording system and train staff to use it
3. collect field data, analyze and evaluate,
4. compare with original data collected and draw lessons,
5. Suggest other minimization tools,
6. Institutionalize within a policy directives incorporating improved HCW minimization processes.

c- Feasibility analysis stage:

1. technical and economic evaluations of the process are made,
2. make sure that among the criteria for technical evaluation are worker safety, maintaining quality of service, compatibility with existing operating procedures and schedules, minimal disruption, and space availability.

d- Periodic Inspection and monitoring:

1. regular monitoring and evaluation could uncover problems,
2. identify areas that need improvement,
3. use the regular inspection as a training tool to educate the staff and further reinforce the directives.

Recommended Waste Minimization Action Plan:

For the purpose of an ownership feeling and practice of a waste minimization plan, the following steps are recommended:

- 1- workers in the sector should understand the HCW definitions through a series of exposure workshops and round tables discussions (time allocation: one month)
- 2- Once definitions are clear, a cost/ benefit concept is introduced to the team. With this, the true cost and potential savings are understood. Again, a number of meetings are to be held for this purpose,(time allocation: one month)
- 3- With this completed, a team should be created/ identified to farther develop the action plan outlined above, including final goals and targets,(time allocated: two months)
- 4- With the plan in place, the first step into segregation is tried and evaluated. (time allocated: two months)
- 5- Within the whole cycle, workers shall be trained and educated on above plans and policies.
- 6- The time frame for all above is 6 months from day one

10.2 Some Examples of Policies and Practices That Encourage Waste Minimization

In accordance with the directives outlined within the draft bylaw and master plan, additional examples are outlined below:

- Purchase/ select supplies and materials that is less wasteful and less hazardous.

- Use less hazardous method in cleaning (e.g. steam disinfection instead of chemical disinfection),
- Centralized purchasing of hazardous chemicals,
- Monitoring of chemical flows within the health facility from receipt as raw materials to disposal as hazardous waste,
- Systematize use of product "first in, first out (FIFO)",
- Frequent ordering of relatively small quantities rather than large amounts at one time (applicable in particular to unstable products/unpredictable consumption rate),
- Use all the contents of each container,
- Checking of the expiry date of all products at the time of delivery and based on its optimum consumption rate,
- If some equipment are designed to be re used and will withstand sterilization process, re use them; examples may include: certain sharps, such as scalpels, glass bottles and containers. After use, these should be collected separately from non-reusable items, carefully washed and sterilized,
- Recycling of papers, metals, glass and plastics if at all possible within the health facilities especially large ones like hospitals that can result in savings for the health care facility either through reduced disposal costs or through payments made by the recycling company.

11- Final Recommendations

11.1 General Recommendation:

Based on the previous analysis of the legal, policy, environmental and cost related of the proposed expansion, the consultant find it feasible to expand the current project as proposed especially that the HCW generated by the private sector is more than the ones generated by the governmental sector.

11.2 Policy and Legal and Institutional Recommendations:

- 1- Regardless of the fact that hazardous health care waste amounts generated within the three cities of Ramallah, Al Bireh and Bitunia specifically, or the district in particular is rather small, the negative impacts can be beyond investment cost and action should be taken to stop further environmental health deteriorations through expansion to cover the three towns in the first phase and possibly to cover the whole district at a later stage.
- 2- The Bylaw of 2008 and the Draft Master Plan of 2005 needs to be finalized and officially approved and endorsed.
- 3- More institutional work is still recommended including the HCW management system, identification of the relation with the RJSC, bylaws, procedures and regulations and the relation with the private sector.
- 4- Both generated waste at the governmental or privately owned institutions should be collected, treated and disposed off safely.

11.3 Technical Recommendations:

- 5- For the private sector, generators are to bring waste to a central treatment facility at this stage, once an educational program is implemented, and licensing is completed, central storage facilities can be placed at a selected number of locations,
- 6- Selection of the final location of the central storage containers are to be decided by all concerned stakeholders.
- 7- All treated waste is to be sent to Ramallah landfill site, and in the meantime, disposal at the current disposal sites can be done given that all dumped waste is to be covered immediately.
- 8- A number of HCW types may not be autoclaved, this might include but not limited to body parts, placenta, and so on; the consultant propose direct land filling in an already identified spot. If social or religious beliefs forbids the spot to be within a landfill site, a know barrier yard can be used.

11.4 Financial Related Recommendations

- 9- Disposal fee for the HCW generated by the private sector should be put in

place immediately.

- 10- The Ramallah municipality health department can be in charge/ manager of the private sector system at this stage until further elaboration on the proper system is completed. Based on this, the Ramallah financial department in consultation with other stakeholders can suggest the fees and collection methodology.
- 11- The RJSC should take the lead in the future to handle the private sector waste generated and the related financial system.
- 12- The RJSC should be in charge of waste transportation from the autoclaves sites to the final disposal location and should be paid for that.

11.5 Awareness, Educational and Knowledge Transfer Recommendations

- 13- It was highly recommended by the workshop participants to look into a detailed educational and awareness program. The consultant supports this and considers highly important especially for the private sector waste generators. The role of local media and possible involvement is worthwhile looking into. The possible role of educational institutions is also important.
- 14- Once a system is in place, the monitoring and inspection procedures should be in place. The role which is divided between the EQA and the MOH should be specified and implemented immediately.

Time Frame and Cost related of policy Recommendations Implementations

Recommendation	Implementation period	Implementing Party	Cost related	notes
Coverage of whole district	A second phase of the proposed one	UNDP or other donors	medium	Other donors are interested, but UNDP should look into this as one program
Official endorsement of the bylaw and master plan	Immediately,	MOH, EQA	No cost	If the PLC is not functional, it should go through a cabinet decree
Definition of RJSC role	Start now	RJSC, and the steering committee	No cost	Discussion can be initiated by the RJSC
Inclusion of private sector waste	Within the proposed system	UNDP, Steering committee	As outlined previously	To be integrated within the proposed system

References Used

- 1- Palestinian Central Bureau of Statistics, (PCBS), 2006. Environmental Survey for Health Care Centers.**
- 2- National Health Strategic Plan (Mid Term Development Plan, 2008-2010), 2008, Ramallah.**
- 3- UNEP, 2003, Desk Study on the Environment in the Occupied Palestinian Territories.**
- 4- World Bank, 2005, Master Plan For Health Care Waste Management, West Bank/Gaza Strip.**
- 5- EQA, Draft Bylaw of 2008 for Health Care Waste Management.**
- 6- UNDP, 2008, Survey Report for Medical Waste in Ramallah, Bitunia and Al Bireh, Unpublished.**
- 7- UNDP, Draft Manual For Health Care Waste Management in Ramallah Governmental Hospital.**
- 8- Al Qaroot Yousef, 2001, An Environmental Health Study of Medical waste in Nablus Hospitals, MSc. Thesis, Al Najah National University.**
- 9- Coad Adrian, 1994. Managing Medical waste in Developing Countries. Geneva, World Health Organization.**

Appendices

Appendix 1: Terms of reference

Terms of Reference Feasibility Study

Project: Medical Waste Management for Ramallah District

Duty Station: Ramallah with possible travel to the West Bank Area

Estimated Duration: six weeks

Starting Date: last week of March

I. Background

Improvement of Medical Waste Management in Ramallah District is a project funded by the Government of Japan. UNDP/PAPP is serving as the Executing and Implementing Agency for the project.

The Beneficiary Agencies/Counterparts are the Environment Quality Authority, the Ministry of Health represented by Ramallah Governmental Hospital and the Ministry of Local Government represented by the Municipality of Ramallah.

The major activities of this project are:

- Assess Medical Waste Management and the current practices including collection, segregation, primary treatment, storage, transportation and final treatment within Ramallah Governmental Hospitals.
- Review and further develop a user friendly Medical Waste Management System/Manual for Ramallah Governmental Hospital.
- Improvement and further Development of the draft available of the National Regulations and Guidelines (to be used by the Health Care facilities and by the Service Providers) to control, manage and treat the Medical Waste in order to protect the public health and safeguard the environment.
- Assess the Medical Waste Management Systems within Ramallah Municipality, including current practices, problems and needs. Based upon the assessments report, develop a medical waste management system (manual) that includes and clarifies all responsibilities and appropriate procedures regarding handling, collection and transfer of medical waste.
- Conduct training activities to strengthen the institutional capacities of the stakeholders and the main beneficiaries of the project.
- Procurement of necessary equipment for Ramallah Governmental Hospital and Municipality of Ramallah.

2 Purposes of the Assignment

- B. To prepare a feasibility study for a possible extension of the scope of work of the ongoing Medical Waste Management Project to cover all service area of Ramallah, Betonia and Albireh Municipalities.

3 Tasks and Responsibilities

Under the overall supervision of the Project Manager, and in close cooperation with the two Project Coordinators and the Project counterparts, the consultant will conduct the following:

To prepare a feasibility study for the extension of the scope of work of the ongoing Medical Waste Management Project to cover all service area of Ramallah, Betonia and Albireh Municipalities. The study should identify basic needed activities and priorities them.

To achieve this, the consultant is expected to:

- Meet with all the projects counterparts.
- Review all relevant documents, i.e. draft Medical Waste Management Master Plan and Bylaws, Medical Waste Management Project Document and other project-related documents.
- Prepare the feasibility report that should include:
 1. Recommendations that indicates whether extending the scope of work of the project is viable or not.
 2. Definition of intended outcomes and cost- benefits analysis that is associated with extending the scope of work of the project.
 3. Economic and financial viability.
 4. Operating requirements including equipments needed for collection, transport and treatment of medical waste.
 5. an action plan for implementation showing the sequence of implementation and the correlated cost
 6. Regulations and environmental issues.
 7. In case the extension of the scope of work requires more funds than those available by the project, the Consultant has to present a first phase action plan for the available budget.
- Suggest a waste reduction/minimization plan for the area under study.
- Discuss the outcomes with the project staff, relevant project counterparts and others in a workshop that will be organized by the UNDP and revise the feasibility study taking all the comments into account.

Qualifications:

- Proven experience in medical waste management systems and related fields.
- A postgraduate degree in Environmental Studies, Engineering or related fields and/or equivalent work experience in preparing feasibility studies for environmental projects.
- Proven experience in management issues.
- Proven experience in financial analysis and preparing feasibility studies for environmental projects.
- Excellent oral and written communication skills in English and Arabic.
- Solid analytical and conceptual skills and the ability to think creatively.
- Good knowledge of local context (culture, politics, and geography).
- Experience in strategic planning.

Level of Efforts

It is estimated that this feasibility study will need six weeks to accomplish including preparing the feasibility study, discussing it in a workshop and updating it based on the comments of the participants. It is anticipated that the work will start during the first week of June.

Payments

The consultant will receive a first payment, 20% of the total amount, after signing the contract and submitting his workplan. A final payment will be issued after the feasibility study is finalized and approved by the project manager.

Logistics

The consultant will be contracted by the UNDP/PAPP. His/her work will be facilitated and supervised by the project manager. The consultant will report to the project manager.

Notes: All required information about the project will be provided together with all data collected during the implementation of the current ongoing project.

Appendix 2

List of People Met

List of stakeholders, experts and individuals met during the report preparation:

	Name	Institution
1	Ms. Taghreed Najjar	UNDP
2	Ms. Saera Rimawi	UNDP
3	Mr. Ayman Sheikh Ibrahim	UNDP
4	Mr. Jad Qandah	Ramallah Municipality
5	Mr. Ibrahim Atteyah	Ministry of Health
6	Mr. Mahmoud Othman	Ministry of Health
7	Ms. Malvina Al Jamal	Ramallah Municipality
8	Mr. Ahmad Abu Dhaher	EQA
9	Mr. Abed Jadai'eh	RJSC
10	Dr. Mahmoud Abdallah	Ramallah Municipality/RJSC
11	Mr. Arafat Khalaf	Beitunia Municipality
12	Mr. Nae'em Saqer	Bitunia Municipality
13	Mr. Mahmoud Nayrookh	Al Bireh Municipality
14	Mr. Yaser Abu Shanab	EQA
15	Mr. Omar Hamayleh	Deputy Mayor/Al Bireh
16	Dr. As'ad Ramlawi	Ministry of Health
17	Dr. Nae'em Sabra	Ministry of Health
18	Dr. Basem Al Rimawi	Ministry of Health
19	Mr. Ammar Sabbouh	Ministry of Health
20	Mr. Sultan Rimawi	Ministry of Health
21	Mr. Suhail Rashmawi	GTZ
22	Mr. Abdul Naser Fari	Ramallah Hospital
23	Ms. Marian Deibes	Ministry of Planning
24	Ms. Reem Khalil	Joint Cooperation Unit of Ramallah, Al Bireh and Bitunia Municipalities
25	Mr. Walid Halayqa	MOLG
26	Dr. Sam Oboche Agbo	UNICEF
27	Ms. Rima Abu Middain	UNDP
28	Ms Mercedes Sanroman	UNDP/ UNICEF
29	Mr. Adham Rishmawi	Medipharm Company
30	Mr. Muhammad Al Khateeb	Red Crescent Hospital - Jerusalem
31	Mr. Mahmoud Abu Shanab	EQA
32	Mr. Adrian Code	Consultant to the UNDP
33	Mr. Saqer Hanatcheh	Ramallah Municipality
34	Mr. Jad Kandah	Ramallah Municipality