4. Capacity Development and Pilot Projects

4 Capacity Development and Pilot Projects

4.1 Capacity Development

4.1.1 Approach for Capacity Development

In order to pursue the objective of the study "To enhance the institutional, organizational, and human capacity related to solid waste management in Ulaanbaatar City", in the discussion of the Inception Report the C/P and the study team set up the structure of the study as described in the Section 1.3.2.

In order to develop the capacities of stakeholders in UBC, the study team proposes a framework for capacity development as shown in the figure below.

a. Weekly Meetings with Technical Working Group

The St/C assigned 21 personnel as the members of the technical working group (TWG). 62 weekly meetings in total were held from the beginning of the study in December 2004 to the end of December 2006. Participants of the meeting normally consisted of permanent members of the TWG. Depending of the topics of each meeting, non-permanent members were invited for discussions. The meeting aimed at developing SWM plan by applying PLA (Participatory Learning and Action). Each meeting spent two to three hours and main agenda discussed were as follow;

- Progress of the study and problems during works, and countermeasures to overcome them;
- Schedule for the following week and its contents,
- Specific topics for certain SWM planning process, such as selection of candidate sites, methodology of finding Waste Flow from WACS results, Alternatives of M/P, etc.

The TWG meetings contributed not only to smooth conduct of the study but also for the core members to understand how to make SWM M/P, and to enhance individual capacity development on SWM. All the topics of the TWG meeting are available in the Data Book.



Figure 4-1: Frameworks of Capacity development in the Study

b. Steering Committee (St/C) Meetings

Many organizations are involved in SWM in Ulaanbaatar. There are certain conflicts among them and these need to be solved in order to reach certain consensus. The St/C meeting aimed at bringing decision of a policy for solutions.

For this purpose, St/C meetings were held five times as follows:

- Discussion and confirmation of the Inception Report;
- Presentation of six candidates for a future disposal site for the central six Districts and confirmation of implementation of the Pilot Project on "Urgent Improvement of the Ulaan Chuluut Disposal Site" which was scheduled to close by the order of the Minister of Environment in January 2005;
- Decision on the selection of Narangiin Enger site as the future disposal site for the central six Districts;
- Discussion of the Interim Report and policy of the M/P, and decision on the priority projects for the Feasibility Study and pilot projects; and
- Decision of the conduct of the Phase 3 study.

c. Pilot Projects Task Forces

As presented in the next Section, many pilot projects (P/Ps) were conducted in this study. The C/P took the initiative in conducting the P/Ps.

Task forces, which consist of the C/P, TWG, NGOs, residents around the project areas, and so on, are formed for Pilot Projects of Urgent Improvement of UCDS and Raising Public Consciousness on Waste issues. The detailed schedule, role of stakeholders, monitoring methods, assessment of the projects, and know how of the projects were discussed.

Task forces will be formed for each Pilot Project. The detailed schedule, role of stakeholders, monitoring methods, assessment of the projects, and know how of the projects will be discussed. At least one C/P will be a member of the Task Forces and manage them. Expected participants are the C/P, TWG, NGOs, residents around the project areas, and so on.

d. Workshop and Seminar

In the study four workshops and three seminars were held. Although planning and management of the workshops and seminars were done by the Team, the C/P took the initiative in presenting topics and answering questions. The reasons why most of the presentations could be done by the C/P are considered as the results of the active participation of the TWG meetings.

e. Selection of the Future Final Disposal Site

The selection work of the future final disposal site for the central six Districts were conducted mainly by the Mongolian side except for the examination works of environmental and economic comparison for the six candidate sites.

f. Execution of EIA Study for the Priority Projects and Public Hearing Meetings

In order to implement development project of the Narangiin Enger Disposal Site and Recycling Complex as soon as possible, the MUB and C/P conducted EIA study and held public hearing meetings three times for the project.

g. Public Relations (P/R) Activities

Public relations activities are important for both the C/P and the citizens of UBC in terms of sharing common and accurate information. In the study the study team in collaboration with the C/P elaborated eight newsletters, home pages, and press tours to achieve optimum effect.

4.1.2 Contents of Support and Monitoring Items for Capacity Development

Following table shows the contents of supports and monitoring items for capacity development.

Capacity Component to be Developed	Contents of Support	Monitoring Items
1. Acquisition, Evaluation and Management of Basic Data on SWM	 Planning, implementation and evaluation of the field investigation Planning, implementation and evaluation of pilot projects (P/Ps) 	 To understand how to acquire basic data on SWM and to evaluate the current SWM by using the data, and to be able to make presentations on it. To be able to calculate the basic data, such as waste amount, operational performances, etc.
2. Planning of Technically Appropriate SWM Components	 Establishment of M/P alternatives Formulation of M/P Planning, implementation and evaluation of P/Ps, and modification of M/P based on the results of P/Ps Implementation of F/S 	 To be able to make presentations about outline of plans knowing the process of planning To be active in evaluating P/P, and feed-back to M/P
3. Participatory Approach in Planning	 P/R activities Planning, implementation, and evaluation of P/Ps 	 To respect the public opinions, and correspond appropriately To reflect the public opinions into the P/Ps through entire operations
4. Initiatives and Accountability	 P/R activities Planning, operation, and presentation of seminars and workshops 	 To create contents of newsletters and web site for P/R voluntarily To establish agenda for meetings, and writing minutes voluntarily To make presentations of study progress and discussed items
5. Strengthening of Partnerships among the Organizations	 Participation of seminars and workshops P/R activities Planning, implementation, and evaluation of P/P 	 To build consensus on role sharing through meetings To be aware of importance of fulfilling roles dispatched to each organization, through P/Ps operations

Table 4-1: Supports and Monitoring Goals in Capacity Development

4.1.3 Evaluation of Capacity Development

a. Evaluation of Capacity Development on Individual Level

Based on the above table, the important issues for the capacity development of the "direct target" are sorted out and monitoring items are set as described in the main report. Then, the Study Team asked the C/P in the mid-February 2006 to evaluate the degree of their capacity development and the results of the evaluation are presented in the following figure. There are 32 items for detailed evaluation and two evaluation methods, i.e. A and B. Method A is for knowledge and capacity of the individual and has scores of Excellent: 4, Good: 3, Fair: 2 and Poor: 1. Method B is the capability to conduct specific works by employing experts and has scores of Without any assistant: 4, With some assistant from the experts: 3, With the instruction by the experts: 2 and Impossible: 1.



Figure 4-2: Evaluation of Capacity Development by C/P

According to the evaluation by the C/P, it brings the following findings:

- According to their evaluation the capacity of C/P has been developed significantly, i.e. their average score after the study is 3.45 (between Good and Excellent or between With some assistant from the experts and Without any assistant) while before the study is only 2.10 (Fair or With the instruction by the experts).
- Regarding evaluation items 4. Initiatives and Accountability and 5. Strengthening of Partnerships among the Organizations, the C/P had high level of capacity even before the study.
- On the other hand, evaluation items 1. Acquisition, Evaluation and Management of Basic Data on SWM and 2. Planning of Technically Appropriate SWM Components, the C/P had few knowledge and capability on them before the study.
- The most improved capacity through the study is item 2. Planning of Technically Appropriate SWM Components and followed by item 1. Acquisition, Evaluation and Management of Basic Data on SWM.
- On the contrary, least improvement item is 5. Strengthening of Partnerships among the Organizations. This fact proves that the most difficult issues is to coordinate and make consensus among different parties. It also indicates difficult coordination between MUB and MOE on the selection of future disposal site.

b. Evaluation of Organization, Institution and Social Level Capacity Development

Through the study capacity development for organization, institution and social level is summarized in the Table below.

Level	Organization	Contents of Capacity Development
Organization	MUB/CDPPD	• SWM plan is established in the City Development M/P and in mid-July 2005 the mayor of the MUB ordered the Narangiin Enger candidate site as the future disposal site for the 6 central Duuregs to secure the site as landfill.
	MUB/CMPUD CMPUA From Sep. 2006	 Based on the recommendation of the study, the MUB established City Maintenance and Public Utility Agency (CMPUA) in September 2006 of which core personnel (5 persons) came from the City Maintenance and Public Utility Division (CMPUD) and takes responsibility on SWM in UBC. CMPUA employed 25 staffs paid by MUB by the end of 2006 and has a plan to employ 15 staffs more to be paid by the municipality. CMPUA is autonomous body which has its own budget and employs its own staffs. With the approval of the mayor and Citizen's Representatives Khural, CMPUD succeeded to increase the budget for SWM, especially to acquire large amount of budget for the Pilot Project (P/P): Urgent Improvement of UCDS. Actually CMPUD received 67,000US\$ for the P/P of UCDS and raised budget of Nuuts Co. in 2006 five times than it in 2005. A future disposal site of the proposed Narangiin Enger disposal site (NEDS) for the 6 central Duuregs was selected by the collaboration and consensus of various organizations concerned. The EIA of the development of NEDS has been approved by MOE. CUPUD conducted three public hearing for the development of NEDS and Narangiin Enger Recycling Complex (NERC).
	MUB/CSIA	 A monitoring committee for USDS was established. CSIA will able to conduct periodical monitoring of the disposal site, and evaluate and publicize the results of the monitoring according to the need.
	Nuuts Co., Operator of the UCDS and MDDS	• The budget of Nuuts in 2006 was raised five times more than it in 2005 to operate disposal sites properly.
	Ministry of Health (MOH)	• Current medical waste (infectious/hazardous waste) management was identified by the Survey on Medical Waste Management in the study. The generation amount of the medical waste and issues of medical waste management were found out.
	Ministry of Construction and Urban Development (MOCUD)	• A survey on construction waste was conducted in the study and generation amount of it and issues of its management were identified.
Institution and Society		 In November 2005 the Citizen's Representatives Khural regulated the current UCDS and MDDS and future NEDS and their surrounding areas as especially reserved areas to prevent the sites from the expansion of Ger area. Based on the financial analysis of the study the waste management fee was revised and enacted from September 1, 2006.
		 In response to the recommendation made by the study, City Waste Service Fund (CWSF) for MUB and District Waste Service Fund (DWSF) for each District were established and commenced operation from January 1, 2007. The WSF improves current waste collection service fee system and enable a cross-subsidy which is the precondition for the expansion of waste collection service to Ger area. The establishment of the WSF significantly improves the current financial system for SWM as shown in the Figure 3.12 of the Section 3.3.8.
		 CMPUD/Nuuts Co. issued ID cards to the 300 waste pickers working in UCDS, the biggest disposal site in UBC. It gives a certain guarantee to the weak of the society. Furthermore, CMPUD/Nuuts Co. organized waste picker and established a Waste Picker Fund which enables them to help each other.

Table 4-2: Evaluation of Organization, Institution and Social Level Capacity Development

4.2 Pilot Projects

4.2.1 Selection of Pilot Projects

a. Objectives of Pilot Projects

The M/P projects may encounter many difficulties when they are implemented. To determine the problems that may arise and to find a way to overcome these difficulties, pilot projects were conducted during the course of this study in cooperation with the counterparts and many concerned parties. The objectives of the pilot projects are summarised below.

- To <u>support construction of organizations to resolve SWM issues in the UBC</u> through the planning, preparation, execution and evaluation of the pilot projects;
- To assess the feasibility of the technical system proposed in the M/P (i.e., establishment of discharge rules, verification of separate collection, etc.).
- To acquire base data so that the design outline of the F/S can be devised (i.e., design of a sanitary landfill reflecting conditions of the study area, examination of mixed combustion method of RDF with coal, etc.).
- Raise public awareness and increase public participation in SWM.
- Demonstrate improvement measures to residents and authorities concerned with SWM.

b. Selection of Pilot Projects

After the discussion with C/P the following pilot projects were selected and approved by the St/C. The pilot projects were conducted in Phase 2 and Phase 3 study stages as follows:

Phase 2 Study Stage:

- P/P 1 Urgent Improvement of the Ulaan Chuluut Disposal Site
- P/P 2 Thermal Recycling "RDF"
- P/P 3 Recycling Pilot Project: Movable Recyclable Collection System "Chirigami Kokan"
- P/P 4 Examination of the Loading Device for Heavy Waste
- P/P 5 Raising Public Consciousness on Waste Issues

Phase 3 Study Stage:

- P/P 1 Continuation of Urgent Improvement of the Ulaan Chuluut Disposal Site
- P/P 2 Continuation of Thermal Recycling "RDF"
- P/P 6 Collection System Improvement (Establishment of Waste Discharge Rules and Introduction of Separate Collection)
- P/P 7 Organization of Waste Pickers

4.2.2 P/P 1: Urgent Improvement of the Ulaan Chuluut Disposal Site

a. Objectives

The objectives of the Pilot Project (P/P) for the Urgent Improvement of Ulaan Chuluut Disposal Site (UCDS) are:

- Objective 1. To establish a control and management system of collected waste in order to avoid illegal dumping; i.e. to dispose of all collected waste in the central 6 Duuregs at the authorized disposal site, i.e. UCDS;
- Objective 2. To dispose of the waste at the designated area of the UCDS. This is the first step of the sanitary landfill operation; and
- Objective 3. To rehabilitate completed landfill area of the UCDS and conduct a sanitary landfill operation as much as possible.

b. Improvement Plan and Achievement of P/P 1

The improvement plan and achievement of the P/P 1 is presented in the following figure and table. In the implementation of P/P 1 the JICA Study Team prepared an improvement plan and constructed facilities, and MUB/Nuuts Co. rehabilitated the completed landfill area and conducted sanitary landfill operation. Both parties cooperated closely each other.



Figure 4-3: Plan of Urgent Improvement of UCDS

Objective	Improvement Plan	Work Assignment	Achievement
	 Registration of collection service organizations and establishment of control system of them 	MUB/ Nuuts	Operation of weighbridge (WB) started on 26 Dec 2005 and registration of collection trucks including TUKs and other organizations started digitally using PC in WB control building.
	 Strengthening control and management capability of Nuuts Co., Ltd. including increase of budget for it 	MUB	Control and management capability of Nuuts Co., Ltd. is being strengthened through the pilot project, C/P training in Japan, etc. Budget of Nuuts has increased to 4 times from Jan 2006 which is 150,000,000 MNT in the year for 2006.
Ohiostivo	Construction of a new control building	JICA ST	The new building is fully completed together with WB and operational from 26 Dec 2005.
1	Unification of access to the southern road	MUB/ Nuuts	As enclosing bank and fences were completed, no access other than the southern road is possible.
	 Installation of a weigh bridge 	JICA ST	Installation of a weigh bridge is completed on 26 Dec 2005
	Development of a database for control & management of waste collection and disposal	JICA ST	Nuuts staffs have received on the job training in control building by JICA ST continuously for around one year. Three persons who are in charge of WB operation are now familiar to operate. Development of a database for control & management of waste collection and disposal is in progress and monthly report was submitted to MUB
	Development of monitoring and control system for illegal dumping	MUB/ Nuuts	MUB is examining monitoring and control system for illegal dumping. The study on construction waste was done by the JICA ST and the results of the study have been analyzed.
	Reexamination of tipping fee	C/P and JICA ST	The tipping fee was examined together with fee collection system and tariff setting. New tariff was set and enforced from 1 st September 2006
	Strengthening enforcement	C/P and JICA ST	System of controlling illegal dump was examined and proposed in the Final Report.
	2.1. Establishment of boundary of the UCDS by installation of a gate, a fence and an enclosing bank	JICA ST	A Gate, a fence and an enclosing bank were constructed to surround the UCDS. Consequently the boundary of the site was established.
	2.2. Prevention of UCDS from expansion of ger area by installing fence or buffer zone	MUB	A buffer zone to protect UCDS from expansion of ger area was approved by the Standing Committee for Environment of the Citizens' Representatives Khural of MUB and necessary measures such as the setting of sign board and boundary structures were conducted. It is being regulated by the Citizens' Representatives Khural of MUB. Green belt was constructed with tree planting to
	0.0 Organization of an	HOA OT	indicate the buffer zone and it was proved that tree can be glowed with proper maintenance.
Objective 2	2.3. Construction of an enclosing dam and bank to establish waste disposal operation area (working face)	JICA ST	An enclosing dam and bank to establish waste disposal operation area (working face) has been completed. 1st working face was filled with waste 2nd enclosing bank was constructed on Dec 2005. 3 rd enclosing bank was constructed on September 2006.
	2.4. Improvement of on-site road	JICA ST & Nuuts	A main on-site road has been completed. But due to the break down of bulldozer, collection truck could not reach to the working face and some part of the road was blocked by the waste.
			On site road was realigned to further west in order to avoid blockage by the wastes.
	2.5. Cleaning waste dumped along the access road and surrounding areas	MUB and JICA ST	MUB contractor and JICA contractor cleaned up waste dumped along the access road and surrounding areas. Cleaned up waste is used for the filling material of enclosing dam.
1			periodically.

Table 4-3: Improvement Plan,	Work Assignment and Achievement of PP 1	
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	3.1.	Installation of gas removal facilities	JICA ST	In total 18 units of gas removal facilities were installed at the UCDS. Some removal facilities need to be extended.
	3.2.	Construction of storm water drain	JICA ST	The storm water drain was constructed together with the enclosing bank.
	3.3.	Installation of leachate treatment facility	JICA ST	Leachate treatment facility that consists of leachate collection facilities and treatment ponds was constructed. There was no leachate outflow observed.
	3.4.	Construction of a warm garage	JICA ST	In order to facilitate smooth operation of landfill equipment in the winter season a warm garage was constructed. Water truck and bulldozer are stored inside.
	3.5.	Construction of Medical Waste Pits	JICA ST	In order to separately dispose medical waste from MSW, medical waste pits are constructed.
	3.6.	Rehabilitation of completed landfill area by re-shaping, slope trimming of existing landfill surface and soil covering	MUB/ Nuuts	MUB contractor has completed the rehabilitation works and about 8ha of land was rehabilitated. One wheel shovel, one excavator and three dump trucks were mobilized and it took around one month to complete. This work should be done during the summer time because soil will be frozen in winter time and it is impossible to excavate cover material.
Objective 3	3.7.	Plan and conduct of waste disposal plan	Nuuts and JICA ST	A rule of UCDS and preliminary disposal plan is drafted by JICA ST. The Nuuts commenced to apply the rule and plan from November 1, 2005.
	3.8.	Conduct of waste compaction and leveling	Nuuts	There are two bulldozers to push and compact wastes in the end of 2006. But both are very old and frequent breakdown and this caused difficulty for the proper operation
	3.9.	Conduct of soil covering	Nuuts	Since almost all facilities required for sanitary operation are completed, MUB/Nuuts could conduct sanitary landfill operation, which shall conduct daily soil covering on waste disposed. However, due to lack of basic equipment for soil cover such as an excavator, dump truck, etc., Nuuts hardly conduct soil covering. Furthermore, it is almost impossible to take soil in winter season because soil is frozen.
	3.10	. Control of waste picking activities	Nuuts	Nuuts conducted registration of waste pickers except new comers in August 2005 and drafted a rule of the UCDS in cooperation with JICA ST.
				Waste pickers meetings were conducted since May 2006 at weekly basis and around 220 WPs were registered. Those registered WPs received ID card with photo.
	3.11	Establishment of a monitoring committee of disposal sites and conduct of periodical monitoring	MUB and JICA ST	The monitoring committee that consists of 9 members was established. The periodical monitoring was conducted 4 times in July, October of 2005 and May, Sep of 2006. Chairman of the committee was changed to the City Specialized Inspection Agency in UB.

c. Issues to be Overcome

The P/P 1 brought many achievement mentioned above. A big handing over ceremony was held on October 26, 2005 when JICA study team finished construction of facilities. Although facilities necessary for the sanitary landfill was prepared, MUB/Nuuts do not have enough equipment for the operation. Although from the year 2006 MUB increased the budget for disposal site operation by Nuuts Co. five times more than it in 2005, Nuuts could not conduct sanitary landfill operation due to lack of an excavator and continuously workable bulldozer for soil cover. As conclusion, Nuuts should find out method to conduct sanitary landfill as much as possible with the available resources including increased budget.

4.2.3 P/P 2: Thermal Recycling "RDF"

a. Background

Municipal Solid Waste (MSW) in UBC contains a large portion of plastic and paper wastes. Especially in apartment area the portion of plastic and paper wastes is 36% and exceeds it of kitchen waste, 34%. Only very small portion of plastic and paper wastes such as PET bottles and cardboard paper are recycled and remaining large portion is subject to disposal sites. These wastes cause many problems to landfill operation such as waste scattering and creation of unstable land due to difficulty of decomposition and compaction. According to the UBC Development Master Plan, the rate of population live in Ger area and Apartment area will change from 46:54 in 2006 to 18:82 in 2020. The fact will increase the portion of plastic and paper wastes. Consequently the problems caused by plastic and paper wastes will be more and more serious.



Plastic and paper wastes scattering in UCDS



Plastic and paper wastes caught by movable fence

In order to solve the above-mentioned problems, paper and plastic waste, which are not recycled at present, will be collected and RDF (RDF: Refuse Derived Fuel) will be produced by using these wastes as raw materials. Produced RDF will be burned at the existing high temperature continuous combustion facilities (power generation plants and heating plants) together with coal and necessary data will be obtained. As a result the problem wastes will be thermally recycled and contribute reduction of energy consumption, i.e. coal consumption.

b. Objectives

The objectives of the P/P 2 are:

- To produce RDF by using paper and plastic waste, which are neither reused nor recycled at present in UBC, as raw materials;
- To burn produced RDF at the existing high temperature continuous combustion facilities (power generation plants and heating plants) together with coal and to examine the impacts of mixed combustion of RDF with coal such as quality of emission gas, reduction of coal consumption and issues for operation; and
- To demonstrate citizens of UBC the technology of RDF production and combustion, and understand them on RDF.

c. Execution and Results

c.1 Production of RDF

c.1.1. Production

RDF can be produced by compacting and heating raw materials. In Japan compaction method is commonly applied to the production of RDF, which melts plastics by the heat generated by pressure. However, to bring compaction type RDF production machine from Japan it difficult

in terms of available budget and time. Therefore, we produced RDF by melting plastics by giving heat from outside. The mixed combustion test of RDF with coal was conducted twice, February and October 2006. Prior to the test 12 tons of RDF was produced between December 2005 to January 2006, and 24 tons of RDF was produced between August 2006 to September 2006.

c.1.2. Results

The table below presents quality of RDF and Coal which was used for the combustion test.

			RI	DF	Co	sal
Physical cor	nposition		1st test	2nd test	1st test	2nd test
Higher calor	ific value	(kcal/kg)	5,820	3,320*1	3,875	4,700*1
Lower calorific value		(kcal/kg)	5,290*1	3,200	2,470*1	3,680
Industrial	Moisture	(%)	8.3	0.9	31.3	19.2
chemical	Combustible	(%)	86.0	74.9	59.9	61.2
analysis	Ash	(%)	5.7	24.2	8.8	19.6
Apparent de	nsity*2		0.41	0.43	0.86	0.87

Table 4-4: Quality of RDF and Coal

Apparent density*2 Note *1: Calculation v

*2: Measurement value by Study team

The table presents the following findings:

- The lower calorific value of RDF produced for the 1st test is more than two times higher than the coal used. It is the quality which we expected.
- The lower calorific value of RDF produced for the 2nd test is only 60% of it of the 1st test due to burning of plastics at production process.
- On the other hand, the lower calorific value of coal used for the 2nd test is 1.5 tomes higher than it of the 1st one.

c.2 Mixed Combustion Test

The mixed combustion test of RDF with coal was conducted twice at the Nalaikh Heating Plant. The impacts of the two tests are summarized below. There was no impacts on the furnace by the tests.

c.2.1. Quality of Emission Gas

Emission gas quality including dioxins was measured at two combustion tests. The study team was worried about the sampling equipment and method applied to the 1st test which used an available sampler in UBC. In order to confirm the data obtained, the team brought sampling tools from Japan and sampled emission gas according to the method specified in JIS (Japan Industrial Standard). In both tests analysis of dioxins was conducted laboratories in Japan.

The results of the emission gas analysis were presented in the table below with the comparison with emission standard value of waste incinerator in Japan and EU.

e *1: Calculation value

Items		Limit value		R Mixed Com	esults of the 1 bustion Test c Coal	st of RDF with	Resul Combustic	ts of the 2 nd N in Test of RDF	fixed ⁼ with Coal	- - -
	Japan (Maximum)	EU ^{*4} (Daily averag	e value)	100% Coal	Coal + RDF (2%)	Coal + RDF (4%)	100% Coal	Coal + RDF (2%)	Coal + RDF (4%)	
Total dust	40 ^{*1} mg/m ³ N	10 mg/m ³ N		315 ^{*5}	431 ^{*5}	380* ⁵	11,800 ^{*5}	7,300 ^{*5}	5,400 ^{*5}	mg/m ³ N
Hydrogen chloride (HCI)	700 mg/m ³ N	10 mg/m ³ N		0.18 ^{*5}	0.30 ^{*5}	0.25 ^{*5}	(HCI could n	NA lot analyzed ir	n Mongolia)	mg/m ³ N
Sulphur dioxide (SO ₂)	K value *2	50 mg/m ³ N		255 (729) * ³	137 (391) * ³	117 (334) ^{*3}	209 (597)* ³	333 (751)* ³	110 (314) ^{*3}	ppm (mg/m ³ N)
Nitrogen oxide (NO _x)	250 ppm (513) ^{*3} mg/m ³ N	200 mg/m ³ N		336 (690) * ³	324 (665) * ³	326 (669) ^{*3}	186 (382)* ³	136 (276) * ³	135 (277) ^{*3}	ppm (mg/m ³ N)
Standard percentage oxygen concentration	12 %	11 %								
	ng-TEQ	o, ng-TEQ	Japanese Standard ^{*6}	0.00008	0.000153	0.000172	0.0078	0.024	0.071	ng-TEQ /m ³ N
טוטאוווא	N ³ N	0.1 /m ³ N	EU's Standard ^{*7}	0.00003	0.000154	0.000174	0.0075	0.020	0.070	ng-TEQ /m ³ N
Note *1: Incineration	capacity is more than 4to	n/hour.	ot contoin aci	با رزید مان از ا رمسر مارد			the V counce	o io monto i o	ولله معنانيم ومراور	locotion with

Table 4-5: Comparison of Emission Gas Analysis Data with Japanese and EU Standard

*2: Japanese standard regulates maximum concentration of SO₂ at certain point (it differs place.) departed from an emission source. K value is regulated according to the location with the range of 17.5-3.0.
*3: Although unit of limit value is set in ppm, we convert it in (mg/m³N) for comparison.
*4: "Imfigure nation of European Council Directive 2000/76/EC on the Incineration of Waste (August 2002, Paper 2002/24)"
*5: The figure nation of Buroposing that the concentration of oxygen is 12%.
*6: Calculation value base on Japanese standard
*7: Calculation value base on EU's standard

c.2.2. Evaluation of Emission Gas

General

• Data obtained by 2nd combustion test is more than reliable because of gas suction instrument brought from Japan.

Dust

- No significant difference on measured values between 100% coal and RDF mixed combustion.
- The measured values far exceed the regulation value for the incinerator in Japan and EU.
- It is necessary to improve the dust precipitator of the furnace.

Sulfur Dioxide (SO₂)

- Measured value shows mixed combustion may improve emission gas on SO₂.
- The measured values exceed the EU emission standard.

Nitrogen Oxide (NO_x)

- No significant difference on measured values between 100% coal and RDF mixed combustion.
- The measured values over the regulation value for the incinerator in EU.

Hydrogen Chloride (HCl)

- No significant difference on measured values between 100% coal and RDF mixed combustion.
- The emission gas satisfied the Japanese and EU emission standard.

Dioxins

- Since concentration of dioxins for mixed combustion are 3.1 9.1 times (2nd test) more than it of 100% coal, RDF mixed combustion impacts on generation of dioxins.
- However, TEQ (Toxic Equivalent) value of RDF mixed combustion, according to the calculation method of the Japanese and EU standard for a solid waste incinerator, is less than 0.1 ng, the strictest value of the Japanese and EU emission standard. It is below the regulation value set in the emission standards in Japan and EU for solid waste incinerators.
- The 2nd combustion test analyzed two states of dioxins in RDF 4% mixture test; i.e. of particle state and gaseous, which is commonly done in Japan. Based on the results, most of dioxins are in the particle state as follow.
- Particle state dioxins: $0.071 \text{ ng-TEQ/m}^3 \text{N}$
- Gaseous dioxins: 0.00046 ng-TEQ/m³N
- This indicates that good bag filter could catch most of dioxins generated by the mixed combustion of RDF with coal.

c.2.3. Evaluation of Heat Balance Results

The boiler efficiency is calculated by the following formula.

Boiler efficiency = (Total calorific value of Outlet water – Total calorific value of Inlet water) / (Total calorific value of Fuel)

The results of calculation of boiler efficiency are shown in the following table.

		Mixed com	bustion test
	100% Coal	RDF2% Mixture	RDF4% Mixture
1st combustion test	41.3 %	53.3 %	67.0 %
2nd combustion test	56.3 %	59.5 %	50.8 %

Table 1-6.	Roiler	Efficiency	of the	Compustion	Tost
	Dollei	Enciency	or the	Compusiion	rest

The table above presents the following findings:

• If the calorific value of RDF is higher than coal, mixed combustion of RDF with coal improve efficiency of boiler.

=> The calorific value of RDF (3,200 kcal/kg) used for the 2^{nd} combustion test is lower than coal (3,680 kcal/kg) due to burning when produced.

=> If RDF made by compaction method calorific value is much higher than it, i.e. more than 5,000 kcal/kg.

• It should be examined carefully whether increase of mixture rate of RDF may cause decease of efficiency or not.

4.2.4 P/P 3: Recycling Pilot Project: Movable Recyclable Collection System "Chirigami Kokan"

a. Objectives

The objective of the Recycling Pilot Project: Movable Recyclable Collection System is to supplement "Buy Back Station" system which is very popular in UBC for recovery recyclable wastes at generation. However, the buy back station system is not so convenient for common residents because it focuses on buying recyclables from waste pickers. The P/P 3 is planned to involve general public for recovery of recyclable wastes at generation.

b. Execution, Results and Findings

b.1 Execution

P/P 3 aimed at the planned area and selected Khoroo 12, 13 and 14 of Bayangol District of which population is 22,676 in total. P/P 3 commenced in October 2005 and ended in March 2006. The P/P 3 was divided into 2 phases as shown in the Table below.

Phase	Period	Khoroo	Assignment of the Study Team	Working Days
1 st Phase	From Oct 2, 2005 to Jan 5, 2006	12, 13, 14	The Study Team provided UNDRAGA with a truck including a driver and petrol required for the operation and the specified number of goods to be swapped with recyclables.	Wednesday and Sunday
2 nd Phase	From Jan 6, 2006 to March 5, 2006	12, 13, 14, 15, 17, 19	The Study Team provided UNDRAGA for only petrol required for the operation.	Saturday and Sunday

Table 4-7: Contents	of P/P	3: "Chirigar	ni Kokan"
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b.2 Results

The buy back station operators have the highest potential to execute the Chirigami Kokan recycle system in future because their business style is the closest to the Chirigami Kokan recycle system. Therefore, one of the buy back station operators, UNDRAGA, was selected

as an executing body. UNDRAGA stopped the operation due to the following reasons when all members of the Study Team were out of Mongolia.

1. The only truck owned by UNDRAGA which was used for the Chirigami Kokan operation was broken down due to the traffic accident. It has not been repaired yet as of August 2006.

2. UNDRAGA judged the operation is not profitable due to the following reasons.

- Maintenance cost of a truck including the rental of warm garage amounting more than 60,000 MNT/month and is too expensive.
- Boost of the gasoline price.
- Lack of cooperation by residents in the khoroo15, 17 and 19 where the project extended in January 2006.

b.3 Findings

The findings through the implementation of the project are summarized as follows:

- Common residents more prefer the method of swapping recyclable for goods rather than for money while poor people prefer money. Swapping for goods makes them comfortable to participate in recycling. The gratitude card attached with goods expressing "thanks for your cooperation to the environmental protection" encourages them for the participation.
- The movable system is inappropriate for the planned area, especially for high rise apartments because they need some time to carry recyclable down to the truck due to wearing warm clothes and taking a lift, etc. The truck often has gone when they came down with recyclable to the truck.
- Use of a truck makes the recyclable collection financially infeasible. Use of a kiosk shop may be more feasible and convenient for residents in the developed area.
- In order to promote common residents to do the separation of recyclables for private recycle route, the environmental education should be given to the residents by the governmental organization such as MUB.

4.2.5 P/P 4 Examination of the Loading Device for Heavy Waste

a. Objectives

The waste collection work in the unplanned area is very labor intensive and slow. One of the causes of this problem is that waste discharged in the unplanned area is heavy throughout the year, because the waste contains a high percentage of ash and wastewater in winter and garden waste with soil in summer.

It is necessary to overcome the issue how to load such heavy waste onto the carrier in order to improve the collection efficiency and the hard working conditions for collection workers. The pilot project aims to find a simple practical system of loading heavy waste onto the carrier.

b. Implementation and Results

The eight devices used for loading waste, which were designed and fabricated by the Study team, were distributed to TUKs for trial usage. The results of trial usage are as follows:

- The workers of TUKs found out that the usage of the device creates more work than the work saved by the device. It doesn't reduce their work load much, taken altogether.
- Therefore the workers of TUKs stopped to use the device.

c. Conclusions

The results of trial usage bring the following conclusions:



Loading Device for Heavy Waste

- In order to develop the device which can be practically used by the collection workers, the works necessary for the use of device shall be as less as possible.
- For the development of such device, the hydraulic system, which may be much more expensive than the device of this P/P, should be adopted.
- Considering the above conclusions, it appears to be better strategy to increase the collection frequency to reduce the waste collection amount from one household at once.

4.2.6 P/P 5: Raising Public Consciousness on Waste Issues

a. Objectives

There are the following two objectives in this pilot project:

- Establishment of a regular participatory monitoring system at the UCDS; and
- Reduction of illegal dumping.

b. Implementation

b.1 Establishment of Regular Participatory Monitoring System at the UCDS

The main objective of the project is to empower local people by raising their awareness and deepening their knowledge on SWM issues, in particular final disposal of waste, so that they would continue to oversee the operation and management of the UCDS after the pilot project at the disposal site is completed.

In order to ensure the continuous proper operation, an institutional system, a regular monitoring system with the participation of local representatives, was established. The monitoring committee, which consists of the environmental authorities and local representatives, implements a regular monitoring.

b.2 Reduction of Illegal Dumping

The project has also a long-term object to reduce illegal dumping by changing people's manner of discharging waste. Without the actual improvement of the collection service, however, it is almost impossible to force them to stop dumping waste in an open space. Therefore, under the pilot project, the team provided a place for both local residents and a collection service provider (TUK of Songinokhairkhan District) to discuss about the current problems and possible solutions in order to share a sense of problems among all the stakeholders. The result of the discussion was reflected in the master plan.

c. Findings and Recommendations

c.1 Establishment of Regular Participatory Monitoring System at the UCDS

c.1.1. Responsible Organization

It is preferable that the locals take a main role in conduction a regular monitoring. At this moment, few local organizations have enough ability to take responsibility of the regular monitoring. In the case of Sri Lank, a Buddhist monk was appointed as the chairperson of the monitoring committee, but in the project site the team could not find an individual, such as a religious leader, who can take a socially responsible role. The team drew a conclusion that the City Specialized Inspection Department was the most suitable body to organize the regular monitoring at this moment.

On the other hand, MUB has a plan to assign one officer in charge of environment issues to all the Khoroos in UB in a future. This could make it possible for the Khoroo government to take on the role of the responsible organization in the future. The team expects that through the monitoring activity the staff of Khoroo 3 & 4 government could acquire the skills and experience in order to assume the responsible role for the monitoring of the new disposal site.

c.1.2. Data management and information disclosure

The participatory evaluation of the pilot project raised the awareness of the local participants. It is necessary to keep the level of this awareness. In addition, it is important to continue to take an effort to promote further public participation. The disclosure of the data of the regular monitoring and sharing it with local residents are very critical in order to realize them.

In general, the disclosure of environment data is not promoted much in MUB. It is necessary for MUB to examine the data management and information disclosure system of the environment data.

c.2 Reduction of Illegal Dumping

Every time, several dozens of local residents participated in meetings and activities. There were a core group of people, who attended almost all activities. Considering the population of the Khoroo 4, it can be said that the influence of the pilot project was limited to some specific people. The team hopes that these people will take a leading role when discharging rules or source-separation is introduced in the future.

In order to expand the effect of the pilot project and to increase the awareness level in the whole community, it is necessary to take another step: introducing discharge rules while improving actual collection system.

During the socialist era, there were regular collection services and local people followed discharge rules. Local people in their 40's and older, with the exception of newcomers, remembered it well. At a community meeting, some of them expressed their willingness to follow new discharge rules if they were introduced. Therefore, once the collection schedule is fixed by increasing or upgrading equipments, it will be possible to introduce discharge rules and then to decrease illegal dumping.

4.2.7 P/P 6: Collection System Improvement

a. Objective

In order to promote 3Rs in Ulaanbaatar, in the M/P the team proposes the introduction of a separate collection system in the planned area. Under the current collection system, however, it is difficult to introduce a separate collection system because the collection schedule is not