

### A.2.3 Outputs of the Workshop

The workshop was conducted according to the program mentioned above. The following photos present the workshop views:



Registration



Opening Speech by State Secretary of MONET



Lecture



Site Visit of NEDA/NERC



Site Visit to MDDS



Site Visit to 3R Promotion Sites



Works in the Workshop (1)



Works in the Workshop (2)



Presentation of Concept of SWM M/P and A/P



Handout of Workshop Certificate



Closing Speech by JICA Resident Representative



Participant and Lectures

**a. Questions and Answers**

In the workshop each program had a question & answer session. The records of question & answer sessions are presented below.

**a.1 Program 4.1 Formulation of M/P for MUB (1): Site Selection (By Mr. Ariguun)**

Mr. Gantumur (Bulgan): In our province, waste has been open dumped in a valley (between two mountains) located near a river for more than 20 years. The area of the waste is more

than 80 ha. However, the amount of the waste is not so much in comparison with the area since it has been just discharged everywhere and scattered around the disposal area. Most of the waste is ash and wood chips. Household waste does not occupy much share in the total waste. The province has been planning to introduce landfill technology in new location and bury the current disposal site (the waste mentioned above). Would you tell me how to calculate the volume of works when we bury the current disposal site?

Mr. Kono (JET): I understood that you have asked how to calculate the volume of a landfill site when planning it in flat areas such as Bayangiin khonkhor, one of the candidates for the final disposal site for UBC. In order to calculate the volume, you have to set the boundary for the landfill site where waste should be disposed. Then, enclosing embankment should be constructed. Unless you follow these steps, waste will be disposed everywhere around the site. Actually, similar problems existed in former UCDS in UBC.

Mr. Gantumur (Bulgan): I would like to know how to protect the river from possible water contamination that might be resulted by the accumulated waste open-dumped in the valley. When discarding the current site after construction of the new landfill site, we will have to take this kind of measures. Is transportation of the accumulated waste to the new site possible?

Mr. Ariguun (EPWMD): Transporting the accumulated waste to a new landfill site is not efficient. Since the waste is open-dumped in the valley, environmental pollution must have occurred in some extent as the waste is located in upstream from the river. Specialized organizations should conduct evaluation of environmental pollution. When doing this, samples should be prepared from soil and water in surrounding area. If the results are within acceptable levels, the waste can be buried. However, the most preferable measure is to dig a hole in the middle of the waste, put a leachate protection liner in the bottom of the hole and bury the waste into it.

Mr. Kono (JET): In order to solve the issue, you need to prepare M/P. In case you are considering that the location of the current disposal site is not proper, then, you should start plan to construct new disposal site. So please be aware of the importance of a M/P. As the M/P was formulated for UBC between 2005 and 2007, NEDS was constructed based on it and started operation in 2009.

As for provincial cities, the MONET is going to support introduction of landfill technology. So you need to formulate M/P to secure the sustainability of landfill operation in your cities. We, the JET, are willing to give advice on possible solutions for the waste open dumped in your current site. Although constructing a sanitary landfilling facility at a final disposal site is a task for your aimag, you have to formulate M/P first in order for you to realise sanitary landfill operation.

#### **a.2 Program 4.2 Formulation of M/P for MUB (2): Planning of 3R System (By Mr. Odjargal)**

After the presentation, the participants requested him to provide them with two regulations on recyclables that have been in force in UBC. The regulations are (1) Regulation on Waste Separation and (2) Regulation on Selling and Purchasing Recyclables.

Mr. Odjargal promised to provide the participants with soft copies of the regulations on the second day of the workshop.

### **a.3 Program 5 Plan and Operation of NEDS and NERC (By Mr. Vandanmagsar)**

Participants: Is protection dams need to be steep?

Mr. Vandanmagsar (CMPUA): It is suitable to construct a protection dam inclining.

Participants: How often is waste separation conducted at NERC?

Mr. Vandanmagsar (CMPUA): Waste separation is being conducted once a week (Mr. Timuujin explained the purpose, progress and implementation method of the pilot project)

Mr. Gantumur (Bulgan): Were there any households who had been residing on the land where the current landfill site (NEDS) is?

Mr. Timuujin (JET): Yes, there were. MUB relocated the households for constructing the site.

Participants: Did the households have official permissions to reside on the land? If so did MUB pay to the households for their relocation?

Mr. Vandanmagsar: We do not know how MUB solved the issue.

### **a.4 Program 7 M/P Framework: Forecast of Waste Amount and Composition, etc (By Mr. Shimura)**

Mr. Gantumur (Bulgan): We found that there are three types of generation rates: for apartment waste, for ger waste and for MSW. What is the generation rate for MSW?

Mr. Shimura (JET): The generation rate for MSW is the total generated waste in a city including that from businesses (but not those generated by construction works, factories and medical institutions) divided by the total population.

### **a.5 Program 8 Plan and Operation of Collection System (Mr. Altangerel)**

In relation to the slide reflected the chart of SWM in Ome city, Japan, some of the participants wanted to know what treatment was done with the hazardous substances that was discharged from inceneration plants with smoke. Mr. Altangerel answered that numerous filters were installed inside this kind of facilities as well as on top of chimneys. Therefore, no hazardous waste is discharged with the smoke.

In addition to this question, one of the participants asked how much waste had been disposed at MDDS when the improvement activity was commenced. Mr. Altangerel stressed that the amount of the waste was not possible to measure since no weighbridges had been installed at the site.

The other questions by the participants and the respective replies by Mr. Altangerel were as follows:

Participants: How much does CMPUA pay to its drivers and collection workers?

Mr. Altangerel (CMPUA): Drivers and collection workers are paid based on the number of trips they conducted. The wage rate is 10,500 Tg/trip for either drivers or collection workers.

Participants: Does the amount of the transportation payment differ from district to district?

Mr. Altangerel (CMPUA): Yes, it does. The BZD-WSF pays CMPUA 65,000 to 75,000 Tg for a trip depending on types of trucks. The average transportation distance from BZD is around 30 km.

Participants: How is the relationship between the disposal site and CMPUA?

Mr. Altangerel (CMPUA): CMPUA operates the final disposal sites (NEDS and MDDS).

In addition to the above, the participants wanted to know the way of implementing penalties in UBC against illegal dumping and violations of the Law on Household and Industrial Waste. In reply to the question, Mr. Altangerel mentioned that the only organization allowed to take penalty measures is Specialized Inspection Agency and its branches.

**b. Outputs of the Workshop**

As mentioned in the objective of the workshop all participants have elaborated their concepts of SWM M/Ps and A/Ps for formulation of the M/P. Those are presented below.

**b.1 Arkangai Aimag**

<p style="text-align: center;"><b>Arkhangai Aimag</b></p> <p style="text-align: center;">M/P General Concept and Action Plan Overview</p>	<p style="text-align: center;"><b>Current issues (for M/P)</b></p> <p>Tsetserleg city has 5 bags, 4000HH and more than 150 business entities. The followings are the current issues of solid waste collection operation:</p> <ul style="list-style-type: none"> <li>- Some HHs are unattended when collection truck comes</li> <li>- Waste collection equipment is used for quite long period of time with frequent breakdowns that enable to provide collection on schedule</li> <li>- Number of current collection equipment is not enough</li> <li>- Fuel provided by a budget is not sufficient for waste collection and disposal operations</li> </ul>
<p style="text-align: center;"><b>Current issues of SWM</b></p> <ul style="list-style-type: none"> <li>- Illegal dumping of construction waste</li> <li>- Open dumping of waste generated from meat processing plant</li> <li>- Waste fee paid as one HH even there are 2-3 HHs in one khashaa</li> <li>- There are not enough work force to distribute PR tools on waste awareness and to load waste thus it is impossible to employ another staff to separate waste</li> <li>- Insufficient number of professional workers</li> </ul>	<p style="text-align: center;"><b>Framework of SWM M/P</b></p> <p>Final disposal site, Ongony Jalga, is located 10-12 km from the city center in BagNo.5 of Erdenebulgan sum. There are human settlements and water sources nearby the disposal site.</p>

### Population and waste generation amount forecast (Table)

Year	Pxx	Pxx_A	Pxx_O	HWAxx (kg/day)	HWAxx (kg/day)	OWAxx (kg/day)	MSWAxx (ton/day)
2011	32197	4186	28012	1172	16947	2845	21.0
2012	36533	4749	31783	1376	19464	3272	24.1
2013	41452	5389	36063	1616	22360	3764	27.7
2014	47033	6114	40919	1898	25695	4332	31.9
2015	53367	6938	46429	2229	29535	4987	36.8
2016	60553	7872	52681	2618	33958	5742	42.3
2017	68706	8932	59774	3074	39055	6614	48.7
2018	77958	10134	67823	3610	44929	7621	56.2
2019	88455	11499	76956	4240	51702	8783	64.7
2020	100365	13048	87318	4979	59513	10125	74.6

### Population growth

Year	Pxx	Pxx_A	Pxx_G
2011	32197	4186	28012
2012	36533	4749	31783
2013	41452	5389	36063
2014	47033	6114	40919
2015	53367	6938	46429
2016	60553	7872	52681
2017	68706	8932	59774
2018	77958	10134	67823
2019	88455	11499	76956
2020	100365	13048	87318

### 7. Required number of collection vehicles

Type of Truck	Capacity	unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor 15m3	Nos	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compactor 8m3	Nos	7.0	1.8	2.1	2.4	2.8	3.2	3.8	4.4	5.0	5.8	6.7
Dump truck 10m3	Nos	9.9	11.3	13.0	15.0	17.2	19.3	22.8	25.8	30.2	34.7	40.0

### Population and waste generation amount forecast (Waste flow)

Year	Pxx	Pxx_A	Pxx_G	HWAxx (kg/day)	HWAxx (kg/day)	OWAxx (kg/day)	MSWAxx (ton/day)	SDWAxx (ton/day)	REWAxx (ton/day)	OFDAxx (ton/day)
2011	32197	4186	28012	1172	16947	2845	21.0	11.8	0.6	8.6
2012	36533	4749	31783	1376	19464	3272	24.1	13.5	0.7	9.9
2013	41452	5389	36063	1616	22360	3764	27.7	15.5	0.8	11.4
2014	47033	6114	40919	1898	25695	4332	31.9	17.9	1.0	13.1
2015	53367	6938	46429	2229	29535	4987	36.8	20.5	1.1	15.1
2016	60553	7872	52681	2618	33958	5742	42.3	23.6	1.3	17.4
2017	68706	8932	59774	3074	39055	6614	48.7	27.1	1.5	20.1
2018	77958	10134	67823	3610	44929	7621	56.2	31.2	1.7	23.2
2019	88455	11499	76956	4240	51702	8783	64.7	35.9	1.9	26.8
2020	100365	13048	87318	4979	59513	10125	74.6	41.4	2.2	31.0

7. Number of Trucks Required

Truck Type	Capacity	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Comp. 1	15-9	0	0	0	0	0	0	0	0	0	0
Comp. 2	15-3	0	19	2	2	2	2	2	2	2	2
Comp. 3	10-9	95	113	110	50	17	13	13	22	25	34

8. Number of trucks to be procured in each year

Truck Type	Capacity	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Comp. 1	15-9	0	0	0	0	0	0	0	0	0	0
Comp. 2	15-3	0	2	0	2	2	2	2	2	2	2
Comp. 3	10-9	10	12	14	15	18	21	24	27	31	35
Total		10	14	14	17	18	21	24	27	31	37

9. Number of trucks to be procured in each year

Truck Type	Capacity	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Comp. 1	15-9	0	0	0	0	0	0	0	0	0	0
Comp. 2	15-3	0	0	0	0	0	0	0	0	0	0
Comp. 3	10-9	10	2	2	1	3	2	3	3	3	3
Total		10	2	2	1	3	2	3	3	3	3

10. Investment Amount in each year refer to "Equipment Cost" table

Truck Type	Capacity	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Comp. 1	15-9	0	0	0	0	0	0	0	0	0	0
Comp. 2	15-3	728,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Comp. 3	10-9	5,450,000.00	185,000.00	185,000.00	815,000.00	255,500.00	185,000.00	255,500.00	255,500.00	425,500.00	38,000.00
Total		6,178,000.00	185,000.00	185,000.00	815,000.00	255,500.00	185,000.00	255,500.00	255,500.00	425,500.00	38,000.00

11. Empty Operation and Maintenance Costs in each year refer to O&M table

Truck Type	Capacity	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Comp. 1	15-9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Comp. 2	15-3	819.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Comp. 3	10-9	1,170.37	232.00	184,600.00	32,250.00	275,700.00	184,600.00	275,700.00	275,700.00	461,200.00	180,000.00
Total		1,989.71	232.00	184,600.00	32,250.00	275,700.00	184,600.00	275,700.00	275,700.00	461,200.00	180,000.00

12. Annual Operation and Maintenance Costs in each year

Truck Type	Capacity	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Comp. 1	15-9	0	0	0	0	0	0	0	0	0	0
Comp. 2	15-3	259.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Comp. 3	10-9	427.22	57.54	67,322.50	35,677.25	101,013.25	67,322.50	101,013.25	101,013.25	168,286.25	73,885.00
Total		686.30	57.54	67,322.50	35,677.25	101,013.25	67,322.50	101,013.25	101,013.25	168,286.25	73,885.00

13. Annual Operation and Maintenance Costs in each year

Truck Type	Capacity	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Comp. 1	15-9	0	0	0	0	0	0	0	0	0	0
Comp. 2	15-3	259.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Comp. 3	10-9	427.22	57.54	67,322.50	35,677.25	101,013.25	67,322.50	101,013.25	101,013.25	168,286.25	73,885.00
Total		686.30	57.54	67,322.50	35,677.25	101,013.25	67,322.50	101,013.25	101,013.25	168,286.25	73,885.00




b.2 Bulgan Aimag

<p><b>Problems existing in SWM in Bulgan province</b></p> <p><u>Technical system-related:</u></p> <ol style="list-style-type: none"> <li>1. The area of the waste disposed at the final disposal site is too large</li> <li>2. Insufficient collection equipment</li> <li>3. The amount of the open-dumped waste has reached to a level at which the accumulated waste results in environmental pollution</li> <li>4. Waste separation and recycling have not been introduced</li> <li>5. The performance by the City Maintenance Company is not sufficient</li> </ol>	<p><u>Institutional system-related:</u></p> <ul style="list-style-type: none"> <li>• Low fee collection rate</li> <li>• Public awareness about SWM activities is not sufficient.</li> <li>• PR activities about SWM are not conducted</li> </ul>																								
<p><b>Framework for SWM M/P</b></p> <ul style="list-style-type: none"> <li>• Location of the final disposal site: In the south east of Bulgan soum, the provincial center</li> <li>• <b>The longitude and latitude of the final disposal site</b></li> </ul> <table border="1"> <tr> <td>North-west point</td> <td>N 480 471 44.1 II</td> </tr> <tr> <td></td> <td>E 1030 341 28.5 II</td> </tr> <tr> <td>North-east point</td> <td>N 480 471 34.1 II</td> </tr> <tr> <td></td> <td>E 1030 341 49.5 II</td> </tr> <tr> <td>East point</td> <td>N 480 471 10.7 II</td> </tr> <tr> <td></td> <td>E 1030 351 01.0 II</td> </tr> <tr> <td>South-east point</td> <td>N 480 461 43.7 II</td> </tr> <tr> <td></td> <td>E 1030 341 02.9 II</td> </tr> <tr> <td>South-west point</td> <td>N 480 461 50.2 II</td> </tr> <tr> <td></td> <td>E 1030 331 31.9 II</td> </tr> <tr> <td>West point</td> <td>N 480 471 15.3 II</td> </tr> <tr> <td></td> <td>E 1030 331 53.1 II</td> </tr> </table>	North-west point	N 480 471 44.1 II		E 1030 341 28.5 II	North-east point	N 480 471 34.1 II		E 1030 341 49.5 II	East point	N 480 471 10.7 II		E 1030 351 01.0 II	South-east point	N 480 461 43.7 II		E 1030 341 02.9 II	South-west point	N 480 461 50.2 II		E 1030 331 31.9 II	West point	N 480 471 15.3 II		E 1030 331 53.1 II	<ul style="list-style-type: none"> <li>• <b>Framework for M/P:</b></li> <li>• The final disposal site of Bulgan province is located in a distance of 8 km in the south-east from the provincial city. We have planned to introduce landfill technology at this site.</li> </ul>
North-west point	N 480 471 44.1 II																								
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b.3 Dornogobi Aimag

<p style="text-align: center;"><b>GENERAL CONCEPT OF THE SWM M/P FOR DORNOGOVI PROVINCE AND ACTION PLAN</b></p>	<p style="text-align: center;"><b>General information</b></p> <ul style="list-style-type: none"> <li>• Population: 21,750</li> <li>• Population growth rate: 15%</li> <li>• Territory: 234,600 ha</li> <li>• Households: 6,229             <ul style="list-style-type: none"> <li>– Apartment: 3,610</li> <li>– Ger: 2,619</li> </ul> </li> <li>• GDP growth: 13%</li> <li>• Waste generation amount: 18,000 ton/year</li> <li>• Area of the final disposal site: 225 ha</li> <li>• Total area of illegal dump sites: 1,275 ha</li> </ul>
<p style="text-align: center;"><b>Problems in SWM</b></p> <ul style="list-style-type: none"> <li>• Dismantled military bases (of former-Soviet army) occupy 770 ha.</li> <li>• Waste resulted from dismantled occupies 502.8 ha.</li> <li>• No enclosing embankment was constructed around the landfill area. Waste is open dumped in considerable areas.</li> <li>• Illegal dumping onto undesignated areas is very active.</li> <li>• Public awareness about SWM activities is at low level.</li> <li>• Waste at ODPs in the city center is combusted frequently.</li> <li>• Waste pickers often scatter waste in the city center.</li> <li>• Collection vehicles and equipment is not sufficient (Waste transporting organization collects waste from only 40% of total generation source, 18% of the generation sources transport by themselves and the rest dump illegally)</li> <li>• Vehicles and equipment has become obsolete. Investment in equipment must be done.</li> <li>• No hazardous waste treatment facility exists.</li> <li>• Fee collection rate is low.</li> <li>• Budget for purchase of fuel and lubricants is not sufficient.</li> </ul>	<p style="text-align: center;"><b>Location of the final disposal site</b></p> 

### Forecasted population of Sainshand city

Normal growth 1,5%

Years	P <sub>xx</sub>	P <sub>xx_A</sub>	P <sub>xx_G</sub>
2011	21456	12445	9012
2012	21770	12627	9143
2013	22088	12811	9277
2014	22411	12998	9413
2015	22739	13188	9550
2016	23071	13381	9690
2017	23408	13577	9832
2018	23751	13775	9975
2019	24098	13977	10121
2020	24450	14181	10269

Rapid growth 5,6%

Years	P <sub>xx</sub>	P <sub>xx_A</sub>	P <sub>xx_G</sub>
2011	35596	19347	13988
2012	36171	20399	14772
2013	37140	21541	15599
2014	38220	22748	16472
2015	41416	24022	17385
2016	43736	25367	18369
2017	46185	26787	19398
2018	48771	28287	20484
2019	51502	29871	21631
2020	54387	31544	22842

### Forecasted waste generation amount

Years	P <sub>xx</sub>	P <sub>xx_A</sub>	P <sub>xx_G</sub>	HWAXX kg/day	HWGXX kg/day	OWAXX kg/day	MSWXX kg/day
2011	21456	12445	9012	2489	8958	1797	132
2012	21770	12627	9143	2543	9128	1832	135
2013	22088	12811	9277	2599	9301	1868	138
2014	22411	12998	9413	2656	9478	1905	140
2015	22739	13188	9550	2714	9659	1942	143
2016	23071	13381	9690	2773	9843	1981	146
2017	23408	13577	9832	2834	10030	2020	149
2018	23751	13775	9975	2895	10222	2059	152
2019	24098	13977	10121	2959	10417	2100	155
2020	24450	14181	10269	3024	10616	2141	158

Normal growth  
1,5%

Rapid  
growth  
5,6%

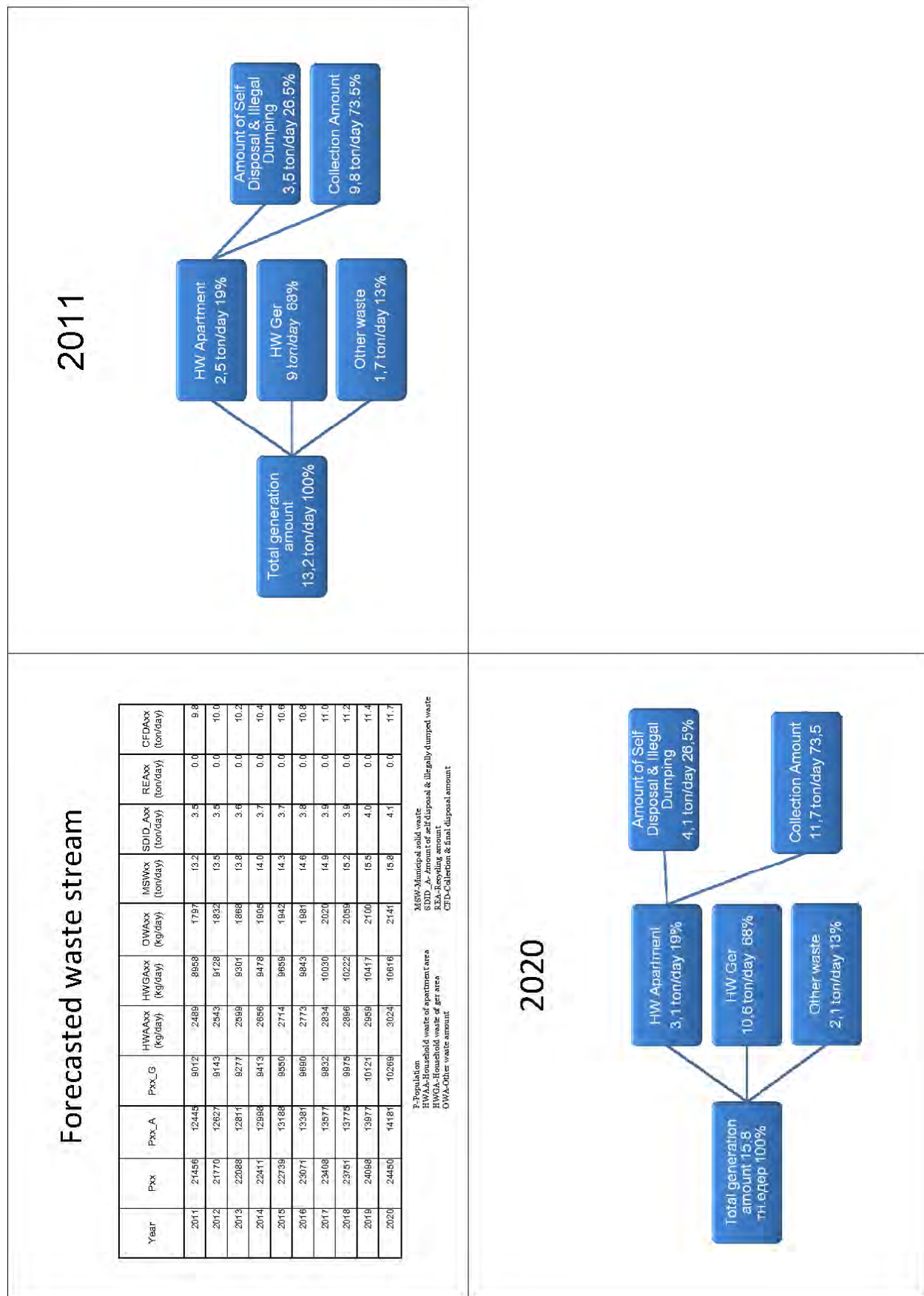
P- Population  
HWAXX- Household waste of  
apartment area  
HWGXX- Household waste of ger area  
OWAXX- Other waste amount

### In case no M/P is implemented:

- 15,8 ton/day
  - Collection amount will be 9,16 ton/day
  - Amount to be dumped illegally is 6,64 ton/day

### Concept of technical system

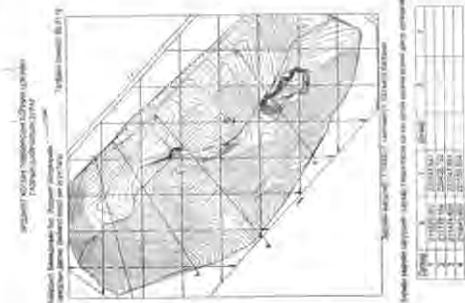
- Compactor trucks will be used in apartment area collection (loading capacities should be 2.5 to 3 tons)
- Dump trucks will be used in ger area collection (loading capacities should be 4 to 5 ton; total number of trucks-3)



b.4 Orkhon Aimag

<p style="text-align: center;"><b>The SWM Master Plan for Erdenet City (draft)</b></p> <p style="text-align: right;">2011</p>	<p style="text-align: center;"><b>General Information about the City (The biggest soum in Mongolia)</b></p> <ul style="list-style-type: none"> <li>- Number of bags (administration unit): 19; Households: 21793; Population: 85121; Total livestock: 147,561 heads.</li> <li>- 7 bags out of the 19 are apartment area while the rest are ger area. Animal husbandry is common in ger areas.</li> <li>- The final disposal site of Erdenet is located at a distance of 26 km from the city center and has been utilized since 1977. Total area is 80.3 ha.</li> </ul>
<p style="text-align: center;"><b>Problems in SWM of Erdenet City (1) (technical system-related)</b></p> <ul style="list-style-type: none"> <li>- The population of Erdenet has increased 2 times for the last decade reaching to 90,000 people.</li> <li>- As 60% of the population live in ger areas (usually remote areas), collecting waste fees from these households is rather difficult. Illegal dumping in valleys, ditches and pastures is common.</li> <li>- Outside discharge points is used in apartment areas. However, many open-dumped illegal sites are generated frequently, and thus, waste pickers, stray dogs and other domestic animals (sheep, goat, cattle etc) scatter these waste in the surrounding environment.</li> <li>- The City maintenance company dispatches 10 dump trucks for waste collection daily. However, the number of trucks are not sufficient for the 19 bags.</li> <li>- As collection trucks are old, breakdowns occur frequently. Fleet renewal is necessary (purchase of new vehicles is necessary).</li> <li>- No buffer zone is set around the final disposal site, and thus, factory-zone (area where factories are located in) extended to the territory of the final disposal site.</li> <li>- No policies or plans are formulated for the final disposal system of the city.</li> <li>- Landfill operation is stopped due to the lack of landfill equipment.</li> <li>- As no weighbridge is installed at the disposal site, the data related to disposal amount is not reliable.</li> </ul>	<p style="text-align: center;"><b>Problems in SWM of Erdenet City (2) (institutional system-related)</b></p> <ul style="list-style-type: none"> <li>- Fee collection in ger area is not systemized; and thus, fee collection rate is considerably low.</li> <li>- Insufficiency in professionalized personnel.</li> <li>- Collection trucks are too old=&gt;fuel utilization rate is high.</li> </ul>

### Framework for SWM M/P



- The final disposal site is located at Altanbulag mountain in the factory zone of Erdenet copper-mine in the territory of Govil bag.
- No historical and cultural heritages, small stream and drinking water sources exist within a radius of 1.5 km from the final disposal site. Distance from the site to the animal farm owned by Erdenet mine is 0.5 km.
- 16 households reside at or around the final disposal site.

### Forecasted population

Years	Total population	Apartment population	Ger population
2009	91518	31116	60402
2010	93192	31685	61507
2011	94896	32265	62631
2012	96631	32855	63777
2013	98398	33455	64943
2014	100198	34067	66131
2015	102030	34690	67340
2016	103896	35325	68571
2017	105796	35970	69825
2018	107730	36628	71102

### Forecasted annual waste generation amounts

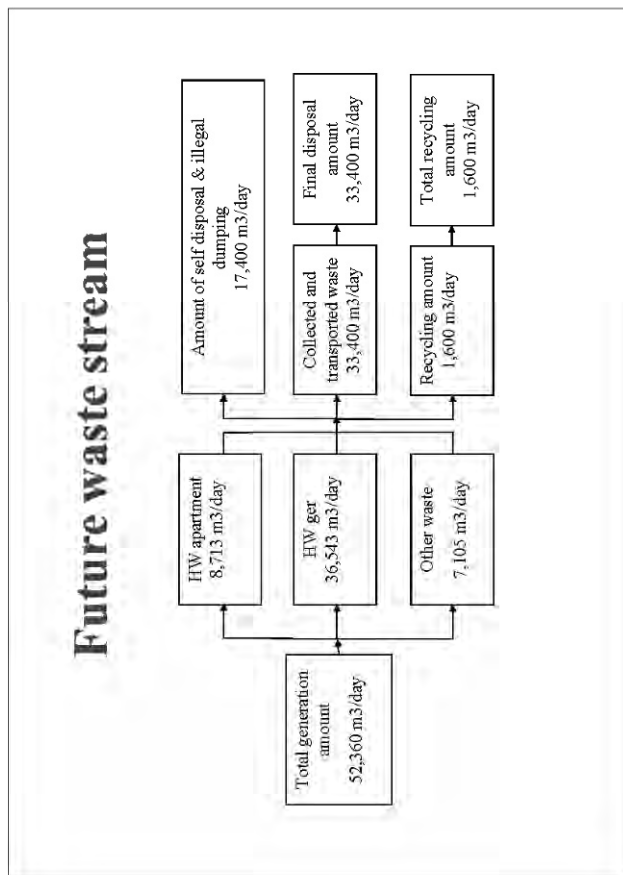
Years	PXX	PXX-A	PXX-G	HWAAXX (kg/day)	HMGAXX (kg/day)	Other waste (kg/day)	MSWXX (ton/day)
2009	91518	31116	60402	8713	36543	7105	52.4
2010	93192	31685	61507	9182	37666	7355	54.2
2011	94896	32265	62631	9678	38833	7616	56.1
2012	96631	32855	63777	10199	40048	7889	58.1
2013	98398	33455	64943	10749	41312	8174	60.2
2014	100198	34067	66131	11329	42628	8471	62.4
2015	102030	34690	67340	11940	43998	8782	64.7
2016	103896	35325	68571	12584	45425	9107	67.1
2017	105796	35970	69825	13263	46912	9447	69.6
2018	107730	36628	71102	13978	48461	9803	72.2

P-Population  
HWAAXX-Household waste of apartment area  
HMGAXX-Household waste of ger area  
OWA-Other waste amount

### Future waste stream (forecasted)

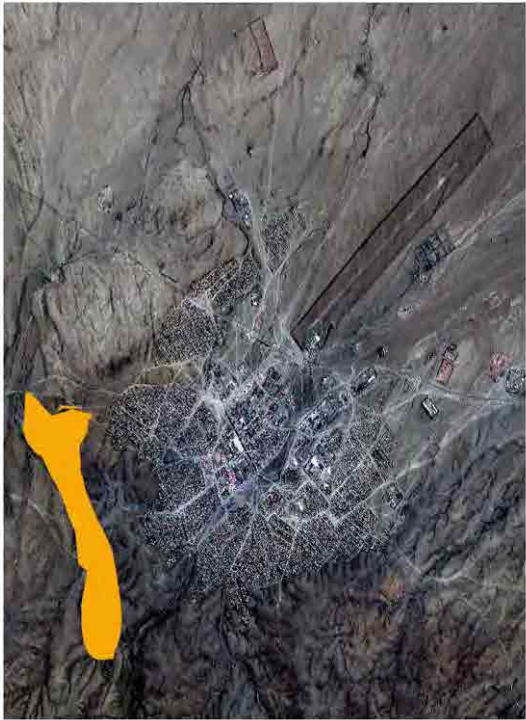

Year	PXX	PXX-A	PXX-G	HWAAXX (kg/day)	HMGAXX (kg/day)	OWAAXX (kg/day)	MSWXX (ton/day)	SIID_AXX (ton/day)	REAXX (ton/day)	CFDAXX (ton/day)
2009	91518	31116	60402	8713	36543	7105	52.36	17.4	1.6	33.4
2010	93192	31685	61507	9182	37666	7355	54.20	18.0	1.6	34.6
2011	94896	32265	62631	9678	38833	7616	56.13	18.5	1.7	35.9
2012	96631	32855	63777	10199	40048	7889	58.14	19.1	1.7	37.3
2013	98398	33455	64943	10749	41312	8174	60.24	19.7	1.8	38.7
2014	100198	34067	66131	11329	42628	8471	62.43	20.4	1.9	40.2
2015	102030	34690	67340	11940	43998	8782	64.72	21.1	1.9	41.7
2016	103896	35325	68571	12584	45425	9107	67.12	21.8	2.0	43.4
2017	105796	35970	69825	13263	46912	9447	69.62	22.5	2.1	45.1
2018	107730	36628	71102	13978	48461	9803	72.24	23.2	2.2	46.8

MSWXX-Household solid waste  
SIID\_AXX - SIID of original & illegally dumped waste  
REAXX-Recycling amount  
CFDAXX-Collection & final disposal amount





b.5 Uvurkhangai Aimag

<p style="text-align: center;"><b>Uvurkhangai province (Arvaikheer city)</b></p> <p><i>General information of Arvaikheer city:</i>          Population: 27,560          Households: 7,788          Number business entities and organizations: 412          Annual waste generation amount: 30,030 ton (ger-8,100 ton;          apartment-1,530 ton; factories-11,400 ton; others-9,000 ton)</p>	<p style="text-align: center;"><b>SWM problems</b></p> <ul style="list-style-type: none"> <li>• Illegal dumping is common.</li> <li>• Newly selected landfill site is not proper in terms of location (ger area has extended to the territory of landfill site).</li> <li>• Collection &amp; transportation requires much time.</li> <li>• Disposal system for construction waste is not appropriate.</li> <li>• Waste at the former disposal site has not been buried completely.</li> <li>• Vehicles and equipment are going to be insufficient by 2013.</li> <li>• Waste separation system does not exist.</li> </ul>
	 <p><b>Final Disposal Site</b></p> <p>Waste transported to the final disposal site is landfilled using WZ bulldozer. The thickness of soil covered over waste is 20 to 30 cm.</p>

<h3 style="text-align: center;">Future technical system</h3> <ul style="list-style-type: none"> <li>• <b>Introduction:</b> Since 2003, Batgun zam partnership has been responsible for waste collection.</li> <li>• The partnership employs 18 workers (leader-1, drivers-6, collection workers-5, operators-4 and sweeping staffs-2).</li> <li>• 3 dump trucks (Russian-made), 2 small-scale trucks (Forland) are dispatched for waste collection in all areas of the city.</li> <li>• A bulldozer WZ-25 operates on landfill operation.</li> </ul>	<p>In 2010, the 5 trucks conducted 4,174 trips and transported 25,044 m<sup>3</sup> waste to the final disposal site.</p> 
<ul style="list-style-type: none"> <li>• A ticket to be distributed to households. It is handed to drivers when waste is collected. The purpose is to confirm the performance by the collection service.</li> </ul> 	<h3 style="text-align: center;">Roles of the ticket</h3> <ul style="list-style-type: none"> <li>• Illegal dumping into ditches decreased;</li> <li>• Responsibilities of residents, drivers and collection workers improved;</li> <li>• Amount of wages to drivers and collection workers became appropriate as it is calculated based on the collected tickets; and</li> <li>• Fee collection rate increased.</li> </ul>

## Framework for SWM M/P

- Waste disposed at the former site need to be buried completely. (Although burying operation was conducted before, it did not complete due to the insufficient budget).
- The newly selected disposal site named Nam Tolgoi Disposal Site is located at a distance of 5 km in the south-east from the soum center. As ger area has extended to the territory of the disposal site, location of the final disposal site should be reselected.
- Waste separation activity being conducted at apartments No.1, 2 and 3 should be improved /waste is being separated into two categories/
- Opportunities of recycling will be sought (currently, a local factory is producing pillars from pet bottles and plastic bags and toilet paper from low quality paper).
- Public awareness and education will be conducted through PR tools.

- The population growth rate is 0.1%.
- Technical capacity should be increased in 2013 by procuring new vehicles and equipment.

## Forecasted population

Years	Total population	Apartment population	Ger population
2011	29676	8903	20773
2012	31955	9587	22369
2013	34409	10323	24086
2014	37051	11115	25936
2015	39897	11969	27928
2016	42960	12888	30072
2017	46259	13878	32381
2018	49812	14943	34868
2019	53637	16091	37546
2020	57755	17327	40429

## Annual waste generation amounts, forecast

Year's	Pxx	Pxx_A	Pxx_G	HWAxxx (kg/day)	HVCAxx (kg/day)	Other waste (kg/day)	MSWxx (ton/day)
2011	29676	8903	20773	2493	12568	2365	17.4
2012	31955	9587	22369	2778	13698	2587	19.1
2013	34409	10323	24086	3096	14934	2831	20.9
2014	37051	11115	25936	3451	16286	3099	22.8
2015	39897	11969	27928	3846	17766	3393	25.0
2016	42960	12888	30072	4286	19385	3716	27.4
2017	46259	13878	32381	4777	21157	4072	30.0
2018	49812	14943	34868	5323	23098	4462	32.9
2019	53637	16091	37546	5933	25228	4852	36.0
2020	57755	17327	40429	6612	27555	5364	39.5

P- Population  
HWA- Household waste of apartment area  
HVCA- Household waste of ger area  
OWA- Other waste amount

## Forecasted landfill volume (required)

Years	CFDAXx (ton/day)	YFDxx (ton/year)	YRLV (m <sup>3</sup> /year)	ARLV (t <sup>3</sup> )
2011	5.3	1943.1	2331.7	2331.7
2012	5.7	2083.2	2499.9	4831.5
2013	6.1	2234.0	2680.8	7512.3
2014	6.6	2396.2	2875.5	10387.8
2015	7.0	2570.9	3085.0	13472.8
2016	7.6	2758.8	3310.6	16783.4
2017	8.1	2961.2	3553.4	20336.8
2018	8.7	3179.0	3814.8	24151.6
2019	9.4	3413.6	4096.3	28248.0
2020	10.0	3686.3	4399.5	32647.9

CFDA=Collection & final disposal amount  
YFD=Yearly final disposal amount  
YRLV=Yearly required landfill volume  
ARLV=Accumulated required landfill volume

## Forecasted amount of waste to be disposed at the disposal site

Year	Pop	Pop_A	Pop_G	H/W/Abcc (kg/day)	C/W/Abcc (kg/day)	M/S/Abcc (ton/day)	SDID_Acc (ton/day)	RE/Abcc (ton/day)	CFD/Abcc (ton/day)	
2011	26976	8903	20773	2493	12568	2366	17.4	7.4	0.5	9.5
2012	31955	9587	22368	2778	13698	2587	19.1	8.1	0.6	10.4
2013	34409	10323	24086	3096	14934	2831	20.8	8.8	0.6	11.4
2014	37051	11115	25936	3451	16286	3099	22.8	9.6	0.7	12.5
2015	39887	11969	27928	3846	17766	3393	25.0	10.5	0.8	13.8
2016	42960	12888	30072	4286	19385	3716	27.4	11.5	0.8	15.1
2017	46258	13878	32381	4777	21167	4072	30.0	12.5	0.9	16.6
2018	49812	14943	34869	5323	23098	4462	32.9	13.7	1.0	18.2
2019	53637	16091	37546	5833	25225	4892	36.0	14.9	1.1	20.0
2020	57755	17327	40428	6612	27556	5364	39.6	16.3	1.2	22.0

P=Population  
BWA=Household waste of apartment  
BWS=Household waste of ger area  
CWA=Other waste amount  
MS=Manufactured solid waste  
SDID\_A=Amount of self disposal & illegally dumped waste  
RE=Recycling amount  
CFD=Collection & final disposal amount

### 9. Vehicles to be procured

Type	Capacity	Unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor	15m <sup>3</sup>	Nos	1	1	1	1	1	1	1	1	2	2
Compactor	8m <sup>3</sup>	Nos	0	0	0	0	0	0	0	0	0	0
C a v o c a n	10m <sup>3</sup>	Nos	3	11	12	13	14	14	14	15	16	17
Total		Nos	4	12	13	14	15	15	15	16	18	21

### 10. Amount of investment by year

Types	Capacity	Unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor	15m <sup>3</sup>	1000 Tg	123500	123500	123500	123500	123500	123500	123500	123500	247000	247000
Compactor	8m <sup>3</sup>	1000 Tg	0	0	0	0	0	0	0	0	0	0
C a v o c a n	10m <sup>3</sup>	1000 Tg	253500	929500	1014000	1058500	1099500	1183000	1183000	1267500	1352000	1436500
Total		1000 Tg	377000	1053000	1137500	1222000	1222000	1306500	1306500	1391000	1599000	1683500

- All apartment waste will be separated at generation source and collected according to the current schedule.
- Number of vehicles to be dispatched to 9 ger areas will be increased and the collection schedule will be adjusted.
- Trucks being used currently will work for ger collection. As apartment area collection needs compactor trucks, new trucks will be procured.
- Financial sources will be planned for procurement of equipment.
- New location will be selected for final disposal site.
- PR activities will be increased.

## Plan of M/P formulation

- A working group for M/P formulation will be organized. The members will be selected from City maintenance company, DoNET, and Department of land relation. Support by the JICA Expert Team is necessary.
- The DoNET will take main responsibility in formulation and implementation of the M/P.
- The M/P will be formulated for 15 years from now.
- Financial sources for implementation of the M/P will be sought from the Central Government, MONET, international projects/organizations and the Local Budget.

b.6 Khuvs gul Aimag

<p style="text-align: center;"><b>Draft of SWM M/P of Khuvs gul Aimag</b></p> <p style="text-align: center;">Khuvs gul aimag Ch. Erdenechimeg B. Khandarmaa</p>	<p style="text-align: center;"><b>Current issues of SWM of Khuvs gul aimag</b></p> <ul style="list-style-type: none"> <li>• Murun sum (Khuvs gul aimag center) has more than 40,000 population, 11,400 HHs, 13 bags and more than 330 business entities.</li> <li>• There is a TUK responsible for waste issues. It has 40 workers. It employs 10-15 drivers and 18-20 loading workers every month on contract basis ensuring temporary job place offering.</li> <li>• Currently TUK has 1 dump ruck and 1 wheel loader.</li> </ul>
<ul style="list-style-type: none"> <li>• TUK collects solid waste from 15 to 30 of every month and disposes waste at a final disposal site, Elstiin Ard.</li> <li>• Waste generated from factories and business entities is collected on call basis.</li> <li>• A final disposal site is located 8 km from the city center and it has a buffer zone within 81 ha of area, and waste is disposed in fenced 39 ha of area.</li> </ul>	<p style="text-align: center;"><b>Positive aspects</b></p> <ul style="list-style-type: none"> <li>• Fixed waste collection schedule every month.</li> <li>• Waste fee collected together electricity bills based on a contract made with "Erchim Khuch" LLC in 2009. every month 6-8 million MNT is invoiced and received from the company.</li> <li>• Business entities with established contracts have already get used to provide waste for regular collection services.</li> <li>• Waste is disposed in designated place at the landfil site.</li> </ul>

## Current issues

### Technical system issues:

- Since waste is collected from every HHs, some HHs discharge waste in the streets which is scattered by WPs, dogs and wind polluting surrounding environment
- Residents discharge waste in the street when before and after collection schedule
- Bag Governor and Environment Protection Inspector are not taking appropriate measures against those residents
- Officers of organizations responsible for waste collection are not eligible to penalize and take actions against environment pollution and waste scattering and dumping cases.

### Institutional system issues:

- Since the city covers about 10,000 ha of area, work force for collection and transportation is not enough to cover such a big area.
- No own equipment. Every month waste collection is provided based on renting 8-10 dump trucks with trailer.
- Above conditions cause economic difficulties. /fuel, spare parts etc./
- There are no compactor trucks, thus causing waste scattering around the city during the collection of waste from central apartment area.
- Landfill area is increasing month by month due to non-provision of pushing equipment.

## Framework of SWM M/P

- We would like to propose to continue utilizing the current Elstiin Ar final disposal site with introduction of improved landfill method. In 2008, MONET financed to purchase a weighbridge and a tractor, then a disposal site was fenced. Landfill area was divided by type of waste such as waste from meat processing plant, inner parts, ash generated from heating plant, construction and hazardous waste.
- A current disposal site is located south-east 8-10 km from the city center, downstream of prevailing wind direction, and it is in a mountain ditch with no drinking water sources. However, if landfill area widens it has a threat to pollute Delgermurun river, thus it is very important to introduce landfill method and rehabilitate by planting grass the unused area.

Location of disposal site of Murun city



ХОГ ХАЯГДЛЫН ХЭТИЙН  
ХЭМЖЭЭ

Year	Pxx	Pxx-A	Pxx-G	HWAxx (kg/day)	HWGAxx (kg/day)	OWAxx (kg/day)	MSWAxx (ton/day)
2011	36195	10859	25337	3040	15329	2884	21.3
2012	36249	10875	25374	3152	15539	2934	21.6
2013	36303	10891	25412	3267	15756	2987	22.0
2014	36358	10907	25450	3386	15981	3041	22.4
2015	36412	10924	25488	3510	16214	3097	22.8
2016	36466	10940	25527	3638	16454	3155	23.2
2017	36521	10956	25565	3771	16703	3214	23.7
2018	36576	10973	25603	3909	16961	3277	24.1
2019	36630	10989	25641	4052	17227	3341	24.6
2020	36685	11006	25680	4200	17502	3407	25.1

Population forecast

Year	Pxx	Pxx-A	Pxx-G
2011	36195	10859	25337
2012	36249	10875	25374
2013	36303	10891	25412
2014	36358	10907	25450
2015	36412	10924	25488
2016	36466	10940	25527
2017	36521	10956	25565
2018	36576	10973	25603
2019	36630	10989	25641
2020	36685	11006	25680

Population growth of Huvsgul aimag is 0.001% annually. apartment and ger area population ratio is calculated as 0.30 and 0.70 percent respectively.

Calculation Sheet for Population Forecast and Future Waste Generation  
Calculation of landfill amount in Elistin Ar disposal site:

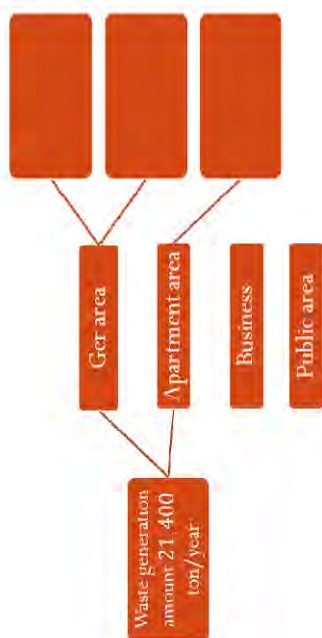
Year	Pxx	Pxx-A	Pxx-G	HWAxx (kg/day)	HWGAxx (kg/day)	OWAxx (kg/day)	MSWAxx (ton/day)	SDIDAxx (ton/day)	REAAxx (ton/day)	CFDAxx (ton/day)
2011	36195	10859	25337	3040	15329	2884	21.3	9.0	0.6	11.6
2012	36249	10875	25374	3152	15539	2934	21.6	9.2	0.6	11.8
2013	36303	10891	25412	3267	15756	2987	22.0	9.3	0.7	12.0
2014	36358	10907	25450	3386	15981	3041	22.4	9.4	0.7	12.3
2015	36412	10924	25488	3510	16214	3097	22.8	9.6	0.7	12.6
2016	36466	10940	25527	3638	16454	3155	23.2	9.7	0.7	12.8
2017	36521	10956	25565	3771	16703	3214	23.7	9.9	0.7	13.1
2018	36576	10973	25603	3909	16961	3277	24.1	10.0	0.7	13.4
2019	36630	10989	25641	4052	17227	3341	24.6	10.2	0.7	13.7
2020	36685	11006	25680	4200	17502	3407	25.1	10.4	0.8	14.0

Daily waste collection amount

Type of area	Waste source	unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Apartment	t/day	3.0	3.2	3.3	3.5	3.6	3.8	4.0	4.2	4.4	4.7	
		2.8	2.9	3.1	3.2	3.4	3.6	3.8	3.9	4.1	4.3	
Ger	t/day	15.0	15.8	16.5	17.4	18.2	19.1	20.1	21.1	22.2	23.3	
		20.8	21.8	22.9	24.1	25.3	26.5	27.9	29.3	30.7	32.3	
Total	t/day											



### Waste flow /in 2010/



### Concept of future technical system

- Introduce bell collection system in apartment area. Collection to be scheduled as twice a week with closure of dust chutes.
- Introduce collection of ger area waste directly from a khasha in suks
- Purchase collection equipment according to the formulated M/P
- Present the formulated M/P to the local aimag Government authorities, and get a support from the budget as well as cooperation from projects and programs

### Calculation of required number of collection trucks up to 2020 :

Type of Truck	Capacity unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor 15m <sup>3</sup>	Nos	1	1	1	1	1	1	1	1	1	1
Compactor 8m <sup>3</sup>	Nos	1	1	1	1	1	1	1	1	1	1
Dump Truck 10m <sup>3</sup>	Nos	+	+	+	+	+	+	+	+	+	+
Total	Nos	6	6	6	6	6	6	7	7	7	8

### Waste Collection Amount by Type and Capacity of Trucks, 2020:

Type of Truck	Capacity unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor 15m <sup>3</sup>	Nos	5+	5.7	6.0	6.5	6.6	6.9	7.3	7.6	8.0	8.4
Compactor 8m <sup>3</sup>	Nos	1+	1+	1.5	1.6	1.6	1.7	1.8	1.9	2.0	2.1
Dump truck 10m <sup>3</sup>	Nos	17.5	18+	19+	20+	21.5	22.5	23.5	24.6	25.8	27.1

### Recycle system proposal

- Organize public awareness raising activities on waste separation and negative impact of waste on human health and environment in cooperation of government and NGOs. Increase responsibilities of bag Governors and social workers
- Support a proposal to establish a waste recycling facility within aimag
- Organize residents who pick wastes
- Step up measures to encourage waste separation at generation sources

Calculation Sheet for Required Landfill Volume

Year	CFDAxx (ton/day)	YFDxx (ton/year)	YRLVxx (m <sup>3</sup> /year)	ARLV (m <sup>3</sup> )
2011	11.6	4234.0	5080.8	5080.8
2012	11.8	4307.0	5168.4	10249.2
2013	12.0	4380.0	5256.0	15505.2
2014	12.3	4489.5	5387.4	20892.6
2015	12.6	4599.0	5518.8	26411.4
2016	12.8	4672.0	5606.4	32017.8
2017	13.1	4781.5	5737.8	37755.6
2018	13.4	4891.0	5869.2	43624.8
2019	13.7	5000.5	6000.6	49625.4
2020	14.0	5110.0	6132.0	55757.4

- Enhance responsibilities of relevant government officials
- Amend waste fee amount by submitting the proposal to the Citizens Representative Khural of aimag
- Approve required regulations
- Cooperate with aimag TV studios and other mass media tools to enhance public education activities

Annual Operation and Maintenance Costs in each year

Type of Truck	Capacity (m <sup>3</sup> )	Unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor	15m <sup>3</sup>	Ts	382,833	382,833	382,833	382,833	382,833	382,833	382,833	382,833	382,833	382,833
Compactor	8m <sup>3</sup>	Ts	102,561	102,561	102,561	102,561	102,561	102,561	102,561	102,561	102,561	102,561
Dump trucks	10m <sup>3</sup>	Ts	602,000	602,000	688,000	688,000	774,000	774,000	860,000	860,000	860,000	860,000
		Total	987,394	987,394	1,073,394	1,073,394	1,159,394	1,159,394	1,245,394	1,245,394	1,245,394	1,245,394

- Approve ordinance on establishment of a working group
- Set up methodology and planning
- Draft a real financial requirements

b.7 Darkhan-Uul Aimag

<p>Darkhan-Uul Province</p> <p><b>Frame WORK FOR SWM MASTER PLAN</b></p>	<p>Problems existing in SWM in Darkhan-Uul Province</p> <ul style="list-style-type: none"> <li>• There are many small-scale illegal dump sites in the provincial city.</li> <li>• Waste separation at generation sources has not been introduced.</li> <li>• Many problems exist in ger area fee collection.</li> </ul>																																												
<p>Framework for SWM Master Plan</p> <ul style="list-style-type: none"> <li>• The final disposal site of Darkhan soum (the provincial center of Darkhan-Uul province) named Baraat DS is located in a valley between two mountains.</li> <li>• Total area: 7 га</li> <li>• Distance to the city: 8 km</li> </ul>	<p>Forecasted population</p> <table border="1"> <thead> <tr> <th>Year</th> <th>Total population</th> <th>Apartment population</th> <th>Ger population</th> </tr> </thead> <tbody> <tr> <td>2011</td> <td>78651</td> <td>47190</td> <td>31460</td> </tr> <tr> <td>2012</td> <td>79770</td> <td>47862</td> <td>31908</td> </tr> <tr> <td>2013</td> <td>80906</td> <td>48543</td> <td>32362</td> </tr> <tr> <td>2014</td> <td>82057</td> <td>49234</td> <td>32823</td> </tr> <tr> <td>2015</td> <td>83225</td> <td>49935</td> <td>33290</td> </tr> <tr> <td>2016</td> <td>84410</td> <td>50646</td> <td>33764</td> </tr> <tr> <td>2017</td> <td>85611</td> <td>51367</td> <td>34244</td> </tr> <tr> <td>2018</td> <td>86829</td> <td>52098</td> <td>34732</td> </tr> <tr> <td>2019</td> <td>88065</td> <td>52839</td> <td>35226</td> </tr> <tr> <td>2020</td> <td>89319</td> <td>53591</td> <td>35727</td> </tr> </tbody> </table>	Year	Total population	Apartment population	Ger population	2011	78651	47190	31460	2012	79770	47862	31908	2013	80906	48543	32362	2014	82057	49234	32823	2015	83225	49935	33290	2016	84410	50646	33764	2017	85611	51367	34244	2018	86829	52098	34732	2019	88065	52839	35226	2020	89319	53591	35727
Year	Total population	Apartment population	Ger population																																										
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Ачж, цуглуулан  
төвлөрсөн хогийн цэгт  
дарж булах хогны хэмжээ  
/ТХЦХХ/

Year	Pxk	Pxk_A	Pxk_G	HWAaxx (kg/day)	OWAaxx (kg/day)	MSWaxx (ton/day)	REAAx (ton/day)	SDI_Aax (ton/day)	CFDAax (ton/day)
2011	78651	47190	31460	13213	19033	5063	11.8	1.1	24.4
2012	79770	47862	31908	13870	19540	5245	12.1	1.2	25.4
2013	80906	48543	32362	14560	20065	5436	12.5	1.2	26.4
2014	82057	49234	32823	15284	20611	5636	12.8	1.2	27.5
2015	83225	49935	33290	16044	21177	5844	13.2	1.3	28.6
2016	84410	50646	33764	16842	21764	6061	13.6	1.3	29.8
2017	85611	51367	34244	17680	22374	6289	14.0	1.4	31.0
2018	86829	52098	34732	18559	23008	6526	14.4	1.4	32.3
2019	88065	52839	35226	19482	23667	6774	14.8	1.5	33.6
2020	89319	53591	35727	20451	24351	7034	15.3	1.6	35.0

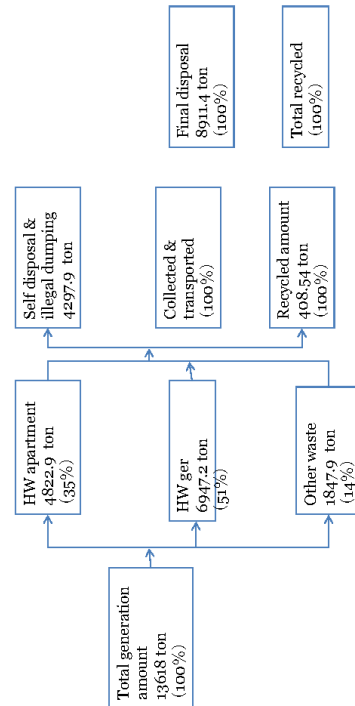
P=Population  
HWA=Household waste of apartment area  
HWA\_G=Household waste of ger area  
OWA=Other waste amount  
MSW=Municipal solid waste  
SDI\_A=Amount of self disposal & illegally dumped waste  
RE=Recycling amount  
CFD=Collection & final disposal amount

Daily generation amounts forecasted for Darkhan soum

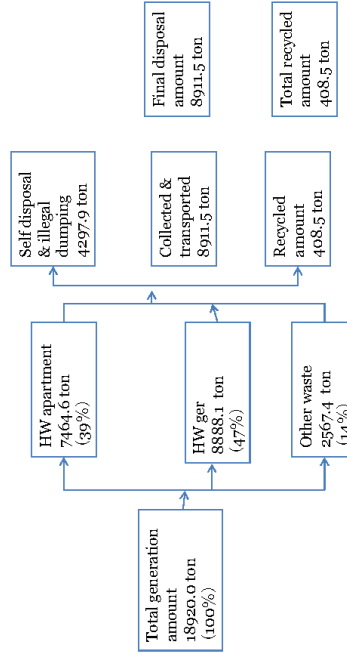
Year	Population	Apartment Population	Ger Population	HWAaxx (kg/day)	OWAaxx (kg/day)	MSWaxx (ton/day)
2011	78651	47190	31460	13213	19033	5063
2012	79770	47862	31908	13870	19540	5245
2013	80906	48543	32362	14560	20065	5436
2014	82057	49234	32823	15284	20611	5636
2015	83225	49935	33290	16044	21177	5844
2016	84410	50646	33764	16842	21764	6061
2017	85611	51367	34244	17680	22374	6289
2018	86829	52098	34732	18559	23008	6526
2019	88065	52839	35226	19482	23667	6774
2020	89319	53591	35727	20451	24351	7034

P=Population  
HWA=Household waste of apartment area  
HWA\_G=Household waste of ger area  
OWA=Other waste amount

Current waste stream in Darkhan soum (2011)



Future waste stream in Darkhan soum (2020)



Техникийн хэтийн  
тогтоцооны үзэл  
баримтлал

8. Number of vehicles counted

Types of vehicles	Unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor	№	2	2	2	2	2	2	2	2	2	3
Truck	№	1	1	1	1	1	1	1	1	1	1
Tractor	№	5	5	5	5	5	5	5	5	5	7
Dump truck	№	3	3	3	3	3	3	3	3	3	11
Total											

9. Number of vehicle to procure (by types of vehicles and by year)

Types of vehicles	Unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor	№	2	0	0	0	0	0	0	0	0	1
Truck	№	2	0	0	0	0	0	0	0	0	0
Tractor	№	7	0	0	0	0	0	0	0	0	0
Dump truck	№	10	0	0	0	0	0	0	0	0	2
Total											

10. Amount of investment by year

Types of vehicles	Unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor	1000 ₮	3,120,000	0	0	0	0	0	0	0	0	0
Truck	1000 ₮	104,000	0	0	0	0	0	0	0	0	0
Tractor	1000 ₮	591,500	0	0	0	0	84,500	0	0	84,500	0
Dump truck	1000 ₮	942,500	0	0	0	0	84,500	0	0	208,000	0
Total											

11. By the O&M cost (by year)

Types of vehicles	Unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor	1000 ₮	283	283	283	283	283	283	283	283	424	424
Truck	1000 ₮	103	103	103	103	103	103	103	103	103	103
Tractor	1000 ₮	602	602	688	688	774	774	861	861	860	946
Dump truck	1000 ₮	988	988	1024	1024	1074	1160	1160	1246	1387	1473
Total											

12. Annual O&M cost (by year)

Types of vehicles	Unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor	1000 ₮	1,032,955	1,032,955	1,032,955	1,032,955	1,032,955	1,032,955	1,032,955	1,032,955	1,547,600	1,547,600
Truck	1000 ₮	372,955	372,955	372,955	372,955	372,955	372,955	372,955	372,955	372,955	372,955
Tractor	1000 ₮	2,160,200	2,160,200	2,488,200	2,488,200	2,774,200	2,774,200	3,060,200	3,060,200	3,059,200	3,347,200
Dump truck	1000 ₮	3,606,200	3,606,200	3,924,000	3,924,000	4,234,000	4,234,000	4,234,000	4,447,900	5,062,555	5,376,455
Total											

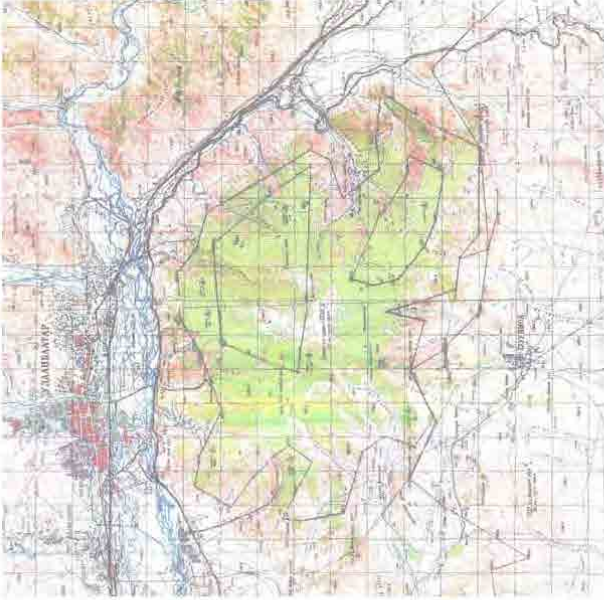
Waste separation and recycling

- Following PR activities will be conducted targeting residents and business entities:
  - ▲ Distributing booklets related to recycling
  - ▲ Organizing seminars
  - ▲ Advertising through mass media
  - ▲ Organizing communities (such as residents groups or partnership) that combats with waste issues.
- A small-scale recycling facility will be constructed.
- Small-scale waste processing factories will be classified by types of target wastes such as plastic processing and paper processing.

Proposal for final disposal system:

- Landfill activity at the final disposal site will be improved.
- Environmental protection measures will be taken.
- Ecosystem equilibrium will be maintained.

b.8 Tuv Aimag

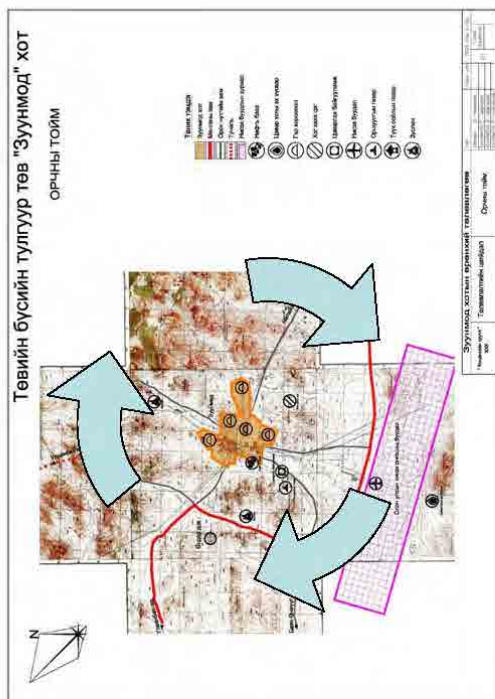
<p style="text-align: center;"><b>Tuv Aimag SWM M/P (draft)</b></p>	
<p style="text-align: center;"><b>Population</b></p> <ul style="list-style-type: none"> <li>• Total aimag population – 87,909 /2010/</li> <li>• Zuunmod city population – 15,295 /2010/</li> <li>• Household – 4,511</li> </ul> <p>Which:</p> <ul style="list-style-type: none"> <li>2,988 ger area households /66 %/</li> <li>1,523 apartment households /34 %/</li> </ul>	<p style="text-align: center;"><b>Future forecast</b></p> <ul style="list-style-type: none"> <li>• Zuunmod City Development 2020 Master Plan has been approved by the Government Decree in 2004. It is planned to be a regional center.</li> <li>• According to the Plan, it is estimated that the number of population will be 22,400 in 2020.</li> </ul>

## Activities of Aimag City Maintenance Department

- Final disposal site has been established by Zuummod Mayor's Ordinance No.10 in 2010. 26 ha of area has been reduced into 18 ha and landfill method is applied in disposal site operations.



## Collection of apartment area waste



<p style="text-align: center;"><b>Equipment list</b></p> <p>8 m<sup>3</sup> -1 truck          3,5 m<sup>3</sup> -2 trucks          0,3 m<sup>3</sup> shovel excavator -1          800 kg crane -1          500 kg tractor with trailer -1</p>	<p style="text-align: center;"><b>Work force</b></p> <ul style="list-style-type: none"> <li>• 5 drivers</li> <li>• 7 loading workers</li> <li>• 9 cleaners</li> </ul>
<p style="text-align: center;"><b>Annual waste generation amount</b></p> <ul style="list-style-type: none"> <li>• Total 16,4 thousand/m<sup>3</sup></li> <li>• Of which: Solid waste - 11 thousand/m<sup>3</sup>              ger area - 7 thousand/m<sup>3</sup>              apartment - 4 thousand/m<sup>3</sup></li> <li>Others - 5,4 thousand/m<sup>3</sup></li> </ul>	<p style="text-align: center;"><b>Fee collection</b></p> <p>After making a contract with power distribution company, waste has been started to be collected together with electricity bills starting from June 2011.</p>



### Population Forecast and Future Waste Generation

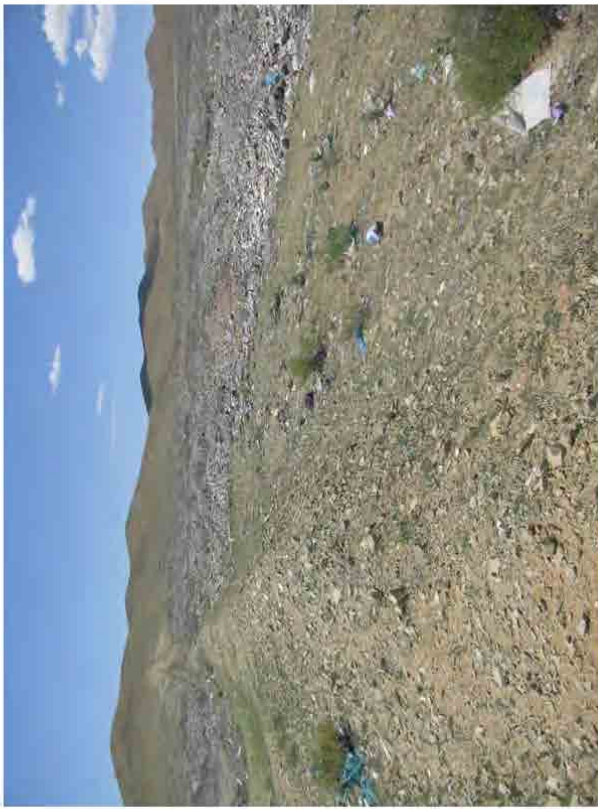

Year	P <sub>tot</sub>	P <sub>ex,A</sub>	P <sub>ex,Q</sub>
2011	15690	5244	10487
2012	16508	5448	10855
2013	17150	5659	11319
2014	17817	5890	11759
2015	18510	6108	12216
2016	19230	6346	12891
2017	19977	6593	13185
2018	20754	6849	13698
2019	21561	7115	14231
2020	22400	7392	14784

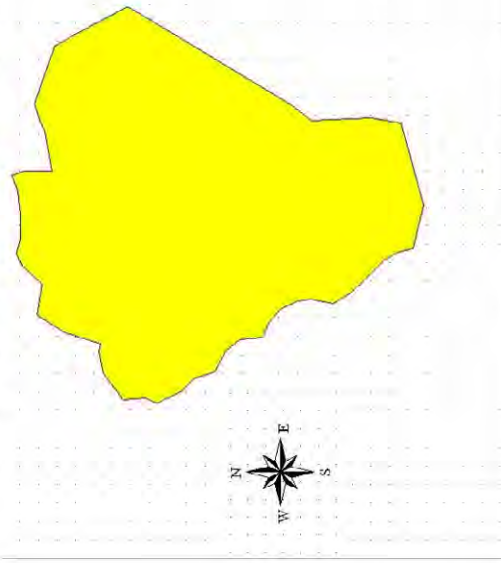
### Waste flow

Year	P <sub>tot</sub>	P <sub>ex,A</sub>	P <sub>ex,Q</sub>	HWGA <sub>ex</sub> (kg/day)	HWMA <sub>ex</sub> (kg/day)	OWFA <sub>ex</sub> (kg/day)	MSWA <sub>ex</sub> (ton/day)	SDLA <sub>ex</sub> (ton/day)	REFA <sub>ex</sub> (ton/day)	CFDA <sub>ex</sub> (ton/day)
2011	15690	5244	10487	1469	6345	1227	9.0	3.8	0.7	4.6
2012	16508	5448	10895	1579	6672	1295	9.5	4.0	0.8	4.8
2013	17150	5659	11319	1698	7016	1368	10.1	4.2	0.8	5.1
2014	17817	5890	11759	1825	7384	1446	10.7	4.4	0.9	5.4
2015	18510	6108	12216	1963	7771	1528	11.3	4.6	0.9	5.8
2016	19230	6346	12891	2110	8181	1616	11.9	4.9	1.0	6.1
2017	19977	6593	13185	2269	8615	1709	12.6	5.1	1.0	6.5
2018	20754	6849	13698	2440	9074	1808	13.3	5.4	1.1	6.9
2019	21561	7115	14231	2623	9561	1913	14.1	5.7	1.1	7.3
2020	22400	7392	14784	2821	10076	2025	14.9	6.0	1.2	7.7

Thank you for your  
attention

b.9 Bayankhongor Aimag

<p style="text-align: center;"><b>SWM Master Plan of Bayankhongor sum</b></p> <p style="text-align: center;">30 June 2011</p>	<p style="text-align: center;"><b>1. Current issues of SWM</b></p> <p>Technical system issues:</p> <ul style="list-style-type: none"><li>❖ Since the final disposal site is located next to Tuin Gol river banks, it becomes a main factor to pollute river</li><li>❖ There is wide spread waste scattering in the city center due to damages of facilities at waste discharge points.</li><li>❖ Waste discharge points located in the city center are burned by residents and business entities without permission causing extensive air pollution problems</li></ul>
	

<p>FINAL DISPOSAL SITE, TOTAL 300 ha</p> 	<p><b>Institutional system</b></p> <ul style="list-style-type: none"> <li>❖ Waste fee is not collected from all households located in ger area</li> <li>❖ Equipment supply worsened and insufficient</li> <li>❖ Poor cooperation and coordination between residents, bag and City Maintenance Department</li> </ul>																																												
<p><b>Framework of SWM M/P</b></p> <p>Proposed final disposal site: Site located in south-west from the city center in Bayan-Ovoo sum area. 6-10 km distance. Background: To be located far from residential area, river banks and flood waterways, and not so far for waste transportation.</p>	<p><b>Population forecast</b></p> <table border="1"> <thead> <tr> <th>Year</th> <th>Pxx</th> <th>Pxx_A</th> <th>Pxx_G</th> </tr> </thead> <tbody> <tr> <td>2011</td> <td>27854</td> <td>8368</td> <td>19498</td> </tr> <tr> <td>2012</td> <td>28114</td> <td>8434</td> <td>19680</td> </tr> <tr> <td>2013</td> <td>28377</td> <td>8513</td> <td>19864</td> </tr> <tr> <td>2014</td> <td>28642</td> <td>8593</td> <td>20050</td> </tr> <tr> <td>2015</td> <td>28910</td> <td>8673</td> <td>20237</td> </tr> <tr> <td>2016</td> <td>29180</td> <td>8754</td> <td>20426</td> </tr> <tr> <td>2017</td> <td>29453</td> <td>8836</td> <td>20617</td> </tr> <tr> <td>2018</td> <td>29728</td> <td>8918</td> <td>20810</td> </tr> <tr> <td>2019</td> <td>30006</td> <td>9002</td> <td>21004</td> </tr> <tr> <td>2020</td> <td>30286</td> <td>9086</td> <td>21200</td> </tr> </tbody> </table>	Year	Pxx	Pxx_A	Pxx_G	2011	27854	8368	19498	2012	28114	8434	19680	2013	28377	8513	19864	2014	28642	8593	20050	2015	28910	8673	20237	2016	29180	8754	20426	2017	29453	8836	20617	2018	29728	8918	20810	2019	30006	9002	21004	2020	30286	9086	21200
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Economic Growth, Waste Amount Forecast  
GR\_GRxx = 0.55 \* GDPav (= 0.0623) = 0.034265 => Say 0.035

Year	P <sub>xx</sub>	P <sub>xxA</sub>	P <sub>xxG</sub>	HWA <sub>xx</sub> (kg/day)	OWA <sub>xx</sub> (kg/day)	MSWA <sub>xx</sub> (ton/day)
2011	27854	8356	19498	2340	11796	16.4
2012	28114	8434	19680	2444	12052	16.8
2013	28377	8513	19864	2553	12316	17.2
2014	28642	8593	20050	2668	12580	17.7
2015	28910	8673	20237	2787	12873	18.1
2016	29180	8754	20426	2911	13167	18.6
2017	29453	8836	20617	3041	13471	19.1
2018	29728	8918	20810	3177	13785	19.6
2019	30006	9002	21004	3319	14112	20.2
2020	30286	9086	21200	3467	14450	20.7

Future waste flow

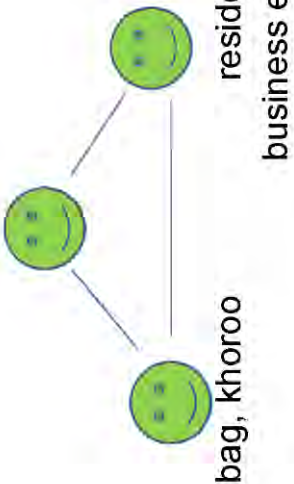
Year	P <sub>xx</sub>	P <sub>xxA</sub>	P <sub>xxG</sub>	HWA <sub>xx</sub> (kg/day)	OWA <sub>xx</sub> (kg/day)	MSWA <sub>xx</sub> (ton/day)	SID <sub>xx</sub> (ton/day)	REA <sub>xx</sub> (ton/day)	CFD <sub>xx</sub> (ton/day)
2011	27854	8356	19498	2340	11786	2219	16.4	7.0	8.9
2012	28114	8434	19680	2444	12052	2276	16.8	7.1	9.2
2013	28377	8513	19864	2553	12316	2335	17.2	7.3	9.4
2014	28642	8593	20050	2668	12580	2395	17.7	7.4	9.7
2015	28910	8673	20237	2787	12873	2459	18.1	7.6	10.0
2016	29180	8754	20426	2911	13167	2524	18.6	7.8	10.3
2017	29453	8836	20617	3041	13471	2592	19.1	8.0	10.6
2018	29728	8918	20810	3177	13785	2663	19.6	8.2	10.9
2019	30006	9002	21004	3319	14112	2737	20.2	8.4	11.2
2020	30286	9086	21200	3467	14450	2813	20.7	8.6	11.5

Concept of future waste collection system

		Daily waste collection amount										
Type of area	Unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Apartment	t/day	2.3	2.5	2.6	2.7	2.8	3.0	3.1	3.3	3.5	3.6	
Business	t/day	2.2	2.3	2.4	2.6	2.7	2.8	3.0	3.1	3.3	3.4	
Other	t/day	11.8	12.4	13.0	13.7	14.3	15.1	15.8	16.6	17.4	18.3	
<b>Total</b>	<b>t/day</b>	<b>16.4</b>	<b>17.2</b>	<b>18.0</b>	<b>18.9</b>	<b>19.9</b>	<b>20.9</b>	<b>21.9</b>	<b>23.0</b>	<b>24.2</b>	<b>25.4</b>	

Number of trucks to be procured in each year

Type of Truck	Capacity	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor	15m3	Nos	1	0	0	0	0	0	0	0	1
Compactor	8m3	Nos	1	0	0	0	0	0	0	0	1
Dump truck	10m3	Nos	3	0	0	1	0	0	0	0	3
<b>Total</b>	<b>Nos</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>5</b>
Investment amount in each year											
Type of Truck	Capacity	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor	1500t	123500	0	0	0	0	0	0	0	123500	0
Compactor	1000t	104000	0	0	0	0	0	0	0	104000	0
Dump truck	1000t	253500	0	0	0	84500	0	0	0	253500	0
<b>Total</b>	<b>1000t</b>	<b>481000</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>84500</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>481000</b>	<b>0</b>

<p>- Recycle – Proposal for waste re-use and recycle Educate residents and provide them with advices: ❖ Importance of waste separation ❖ Use and consumption of waste recycled goods ❖ Organize residents into community system and establish model khoroo or streets ❖ Educate and cooperate with people who are living by picking waste</p>	<p>For waste service organizations:</p> <ul style="list-style-type: none"> <li>• Organize trainings on waste separation system</li> <li>• Organize trainings to strengthen human resources</li> <li>• Improve a monitoring system of services</li> <li>• Improve supply and quality of equipment</li> </ul>
<p>City maintenance</p>  <p>bag, khoroo      resident, business entity</p> <p>Improve cooperation</p>	<p>Concept of improvement for institutional system</p> <ul style="list-style-type: none"> <li>❖ Introduce a system of collection of waste fees together with electricity bills</li> <li>❖ Improve regular monthly waste collection system by introduction of fixed schedule that is to be informed to the residents</li> <li>❖ Organize public waste awareness raising activities, trainings and seminars, and establish a system of awards and promotions</li> </ul>

## A/P to formulate M/P

### ❖ RESPONSIBLE ORGANIZATION, OFFICER:

#### Aimag Government Office:

- Officer in charge of environment issues, Division of Development Policy
- Officer in charge of health issues, Division of Social Policy

#### DONET (Department of Nature, Environment and Tourism):

- Officer in charge of environment pollution and waste management

#### DOH (Department of Health):

- Officer in charge of environment pollution

#### City Government Office

- Manager, Mayor's Office

#### CMPJA (City Maintenance and Services Department):

- Manager in charge of waste transportation issues

#### All bag (duureg, khoroo) Governors

## b.10 Govisumber Aimag

<h3>SWM M/P framework of Govisumber aimag</h3>	<ul style="list-style-type: none"><li>• Govisumber aimag has 3 sums. Sumer sum has 376,819 ha of area where 1,058.37 ton of waste is accumulated in 1,010.2 ha.</li><li>• Out of above waste, “soft” waste covers 65 ha.</li><li>• Bayantal sum has 91,606 ha of area where 28,996 ton of waste is accumulated in 35.7 ha.</li><li>• Shiveegovi sum has 85,755 ha of area where 542,200.6 ton of waste is accumulated in 18.2 ha.</li></ul>
<h3>SWM current issues</h3> <ol style="list-style-type: none"><li>1. Old, accumulated waste is scattered and covers huge area</li><li>2. Not enough waste collection services</li><li>3. Many open dumping places</li><li>4. Not enough waste fee collection rate</li></ol>	<ol style="list-style-type: none"><li>5. No final disposal site that meets required standard criteria</li><li>6. There are no collection and maintenance companies operating in Bayantal and Shiveegovi sums</li><li>7. Not enough financing</li></ol>

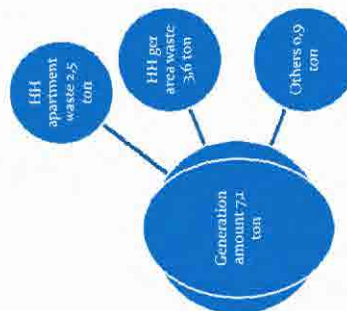
## Technical system issues

- Landfill equipment is essential for introduction of landfill method since final disposal amount is increasing. Current 4 loading workers and 1 watchmen and 1 tractor operator are not enough for waste collection operations.

## Location of final disposal site

- Located in old sand mining pit, about 7 km north west side of the city.
- Name: Orbity Tseg
- Area: 14.32 ha

## Future waste flow



## Population forecast

Year	Pop	Pop_A	Pop_G
2011	14888	8838	5956
2012	15298	9178	6118
2013	15709	9428	6284
2014	16131	9679	6453
2015	16585	9938	6626
2016	17010	10206	6804
2017	17467	10480	6987
2018	17936	10762	7175
2019	18418	11051	7367
2020	18813	11348	7565



### 1. Daily collection amount

Waste source	unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Apartment	l/day	2.5	2.6	2.8	3.0	3.2	3.4	3.5	3.7	3.8	
Business	t/day	0.0	0.0	1.0	1.1	1.1	1.2	1.2	1.2	1.4	
Ger	t/day	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.1	5.2	5.8
Total	t/day	7.0	7.4	7.7	8.1	8.5	8.8	8.4	8.6	10.8	10.8

### 2. Daily Waste Collection Amount: by type of collection trucks

Type of Truck	unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Apartment	l/day	2.5	2.6	2.8	3.0	3.2	3.4	3.5	3.7	3.8	
Business	t/day	0.0	0.0	1.0	1.1	1.1	1.2	1.2	1.2	1.4	
Ger	t/day	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.1	5.2	5.8
DT Total	t/day	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.1	5.2	5.8

### 3. Waste Collection Amount by Type and Capacity of Trucks

Type of Truck	Capacity	unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor	15m3	l/day	4.0	4.2	4.4	4.6	4.8	5.1	5.2	5.6	5.8	8.2
Compactor	8m3	t/day	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dump truck	10m3	t/day	4.2	4.4	4.6	4.8	5.1	5.4	5.6	5.8	8.2	8.5

### 4. Selection of Capacity of Compactor

Type of Truck	Capacity	unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor	15m3	%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Compactor	8m3	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Dump truck	10m3	%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

### 5. Waste Collection Amount by Type and Capacity of Trucks

Type of Truck	Capacity	unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor	15m3	l/day	4.0	4.2	4.4	4.6	4.8	5.1	5.2	5.6	5.8	8.2
Compactor	8m3	t/day	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dump truck	10m3	t/day	4.2	4.4	4.6	4.8	5.1	5.4	5.6	5.8	8.2	8.5
Total		t/day	8.2	8.6	9.0	9.5	9.9	10.4	10.8	11.4	12.1	12.7

### 6. Average Trip per day by type of trucks

Type of Truck	Capacity	unit	Average haulage amount per trip									
			2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor	15m3	l/day	4.0	4.2	4.4	4.6	4.8	5.1	5.2	5.6	5.8	8.2
Compactor	8m3	t/day	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dump truck	10m3	t/day	4.2	4.4	4.6	4.8	5.1	5.4	5.6	5.8	8.2	8.5

### Future Waste Generation calculation sheet (2)

Year	Pxx	PxxA	PxxG	HWAxx (kg/day)	HWAxx (kg/day)	OWAxx (kg/day)	MSWxx (ton/day)
2011	14898	8839	9595	2503	3602	948	7.1
2012	15298	9179	8119	2692	3742	1068	7.4
2013	15769	9435	6294	2827	3895	1066	7.8
2014	16131	9679	6452	3002	4052	1108	8.2
2015	16950	9939	6926	3193	4219	1163	8.6
2016	17019	10208	8024	3594	4588	1221	9.0
2017	17467	10493	8997	3907	4995	1283	9.5
2018	17938	10782	7175	3634	4752	1346	9.8
2019	18418	11051	7367	4073	4950	1417	10.4
2020	18913	11348	7565	4331	5156	1488	11.0

### 3. Waste Collection Amount per day by type of trucks in case 1 day off in a week

Type of Truck	unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor	l/day	4.0	4.2	4.4	4.6	4.8	5.1	5.2	5.6	5.8	8.2
Dump truck	t/day	4.2	4.4	4.6	4.8	5.1	5.4	5.6	5.8	8.2	8.5
Total	t/day	8.2	8.6	9.0	9.5	9.9	10.4	10.8	11.4	12.1	12.7

### 4. Selection of Capacity of Compactor

Type of Truck	Capacity	unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Compactor	15m3	%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Compactor	8m3	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Dump truck	10m3	%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

## A.2.4 Evaluation of the Success of the Workshop

### a. Participant Evaluation

#### a.1 Questionnaire

### Questionnaires on the Workshop for Formulation and Implementation of SWM M/P at Central Provincial Cities based on the Experience in UBC

Please answer the following questions on the Workshop for Formulation and Implementation of SWM M/P at Central Provincial Cities based on the Experience in UBC. We would like to make use of your answers to improve our assistance for the improvement of SWM in provincial cities.

#### **Question 1: What organization do you belong to?**

1.1 Name of Aimag:

1.2 Name of Organization:

1.3 Position:

#### **Question 2: Do you think this Workshop is useful for you to prepare SWM M/P in your cities?**

2.1 Yes

2.2 No

#### **Question 3: If you answer YES for the Question 2, please inform of which programs (tick the column) and what part of them (please describe) do you think useful for you to prepare SWM M/P in your cities? (plural answer)**

Tick	Program	Part which is useful
	P.2 Objectives and contents of the workshop	
	P.3 Need and work flow of M/P formulation	
	P.4.1 Formulation of M/P for MUB (1): Site selection	

	P.4.2 Formulation of M/P for MUB (2): Planning of 3R system	
	P.5 Plan and operation of NEDS and NERC	
	P.6 Site visit of NEDS and NERC	
	P.7 M/P framework: Forecast of waste amount and composition, etc.	
	P.8 Plan and operation of collection system	
	P.9 Site visit of 3R promotion sites, workshop, etc.	
	P.10 Workshop (1): Preparation of framework for SWM M/P for each city	
	P.11 Workshop (2): Collection system planning for SWM M/P for each city	
	P.12 Workshop (3): Final disposal system planning for SWM M/P for each city	
	P.13 Workshop (4): Recycling system planning for SWM M/P for each city	
	P.14 Workshop (5): Formulation of concept of SWM M/P for each city and an action plan (A/P) for formulation of the M/P	
	P.15 Presentation of the concept of SWM M/P and the A/P for formulation of the M/P by 10 cities	

**Question 4: What kind of knowledge and experience did you gain in the workshop?  
 Please write the matters of which you think were useful and interesting.  
 In addition please mark the most useful one. (circle it ○)**

**Question 5-1: What did you want to learn through this workshop?**

**Question 5-2: Were you able to obtain such knowledge through this workshop?**

2.1 Yes

2.2 No

**Question 6: Do you have any opinions to improve this workshop? What kind of program do you need more about? Please describe below, if any?**

Opinion to improve the workshop:

Additional programs you need:

**Question 7: What kind of support do you need for the formulation of M/P for your city?**

(From central government)

(From JICA)

**Question 8: What kind of support do you need for improvement of SWM in your city?**

(From central government)

(From JICA)

*Thank you very much for your cooperation!*

**a.2 Answers**

17 of 18 Participants in total gave answers to the questionnaire. The one who did not left early due to some urgent works.

**Question 2: Do you think this Workshop is useful for you to prepare SWM M/P in your cities?**

**Answer 2:**

	Nos of Answer	Percentage
2.1 Yes	17	100%
2.2 No	0	0%

**Question 3: If you answer YES for the Question 2, please inform of which programs (tick the column) and what part of them (please describe) do you think useful for you to prepare SWM M/P in your cities? (plural answer)**

**Answer 3:**

Tick		Program	Part which is useful
Nos	%		
15	88	P.2 Objectives and contents of the workshop	The workshop objectives are appropriate. The workshop is effective and useful.
16	94	P.3 Need and work flow of M/P formulation	Work flow to formulate the M/P. Needs and method of formulation of the M/P. Whole program
15	88	P.4.1 Formulation of M/P for MUB (1): Site selection	Site selection method. Kinds of investigation s needs for site

			selection. Entire program. Useful for assessment of our disposal site
16	94	P.4.2 Formulation of M/P for MUB (2): Planning of 3R system	3R system in UBC. Planning 3R system. Entire program. Method of attracting people
14	82	P.5 Plan and operation of NEDS and NERC	Entire program. Method of how to make a plan and implement it. Experience of MUB
16	94	P.6 Site visit of NEDS and NERC	To understand experience of MUB How to implement proper landfill operation Whole program
15	88	P.7 M/P framework: Forecast of waste amount and composition, etc.	Forecast method of population and waste generation amount. To understand necessity of basic data for M/P formulation.
16	94	P.8 Plan and operation of collection system	Whole program To get basic knowledge for collection system planning
17	100	P.9 Site visit of 3R promotion sites, workshop, etc.	To know public education. Communication with local officers engaged in the program Experiences (clean environment, etc.) in the khoroo
17	100	P.10 Workshop (1): Preparation of framework for SWM M/P for each city	To learn how to make framework (calculation of future population and waste generation amount) by myself using PC having instructions & advices. Practicing is very useful Entire program
17	100	P.11 Workshop (2): Collection system planning for SWM M/P for each city	To learn how to calculate number and types of collection vehicles

			To learn how to plan a collection system in Aimag Practicing is very useful
14	82	P.12 Workshop (3): Final disposal system planning for SWM M/P for each city	Practicing is very useful. To learn how to calculate required landfill area To learn how to plan a final disposal system
14	82	P.13 Workshop (4): Recycling system planning for SWM M/P for each city	To learn how to plan a recycling system Practicing is very useful
14*1	82	P.14 Workshop (5): Formulation of concept of SWM M/P for each city and an action plan (A/P) for formulation of the M/P  P.15 Presentation of the concept of SWM M/P and the A/P for formulation of the M/P by 10 cities	To learn how to plan a recycling system Practicing is very useful Learned experiences of other aimags

(Note) There is miss-typing of questionnaire (Double item 14) in Mongolian version. Therefore, the answer made combined.

**Question 4: What kind of knowledge and experience did you gain in the workshop? Please write the matters of which you think were useful and interesting. In addition please mark the most useful one. (circle it ○)**

**Answer 4:**

Knowledge and Experience gained in the Workshop	Nos	%
1. Methodologies and experiences to formulate M/P.	12	71
2. I have become able to forecast population, waste amount and composition	10	59
3. I have become able to plan waste collection, transportation and recycle activities.	4	24
3. Disposal site operation and 3R activities based on experiences of NEDS and 3R pilot khoroo	4	24
4. Task to be completed on PC by participants themselves	3	18
4. Evaluation of candidate sites for Final Disposal	3	18
5. All necessary knowledge and experiences	2	12
5. Method to organize work on site (landfill planning)	2	12
6. Ideas from presentations conducted by provinces	1	6

6. Necessary information was obtained in proper timing	1	6
6. New ideas for SWM improvement	1	6
6. About RPF	1	6
6. Closure and rehabilitation of old disposal site	1	6
6. PR activities and way of enhancing resident's participation	1	6
6. Cooperation activities with WPs	1	6
6. method of field investigations	1	6
6. International experiences	1	6

**Question 5-1: What did you want to learn through this workshop?**

**Answer 5-1:**

Aspects to be expected to learn through the Workshop	Nos	%
1. Method to formulate M/P.	11	65
2. Method of implementing landfill	6	35
3. Method to conduct necessary surveys and calculations	5	29
3. Method to forecast population and waste generation amounts	5	29
4. Other SWM information/knowledge	1	6
4. Items contained in the programs	1	6
4. Preparation of collection schedule	1	6
4. Financial planning	1	6
4. Way of promoting 3Rs	1	6
4. All those transferred through the workshop	1	6

**Question 5-2: Were you able to obtain such knowledge through this workshop?**

**Answer 5-2:**

	Nos of Answer	Percentage
5.1 Yes	17	100%
5.2 No	0	0%

**Question 6: Do you have any opinions to improve this workshop? What kind of program do you need more about? Please describe below, if any?**

**Answer 6-1: Opinions to improve the workshop**



Opinions to improve this Workshop	Nos	%
1. I am satisfied with the effectiveness and results of this workshop.	7	41
2. To organize the workshop in one of the participants' provinces based on its condition	4	24
3. To extend time for workshops (to extend the total duration of the entire program)	2	12
4. To invite representatives from organizations implementing SWM as soon as possible	1	6
4. To conduct landfill at final disposal site completely	1	6
4. It would be more useful by implementing all process jointly in one selected region	1	6

**Answer 6-2: Program you need more**

Program to be provided in the another Workshop	Nos	%
1. Methods to improve public awareness, attitude and education	4	24
2. Hazardous and medical waste treatment technology (Classifications, collection and disposal methods and other necessary technological aspects).	2	12
2. Experiences in foreign countries, especially those related to waste collection and recycling. Good practice in other countries	2	12
3. Waste recycling methods and technologies that suits the conditions in Mongolia	1	6
3. Study tour to recycling factories located in UBC.	1	6
3. City development plan	1	6
3. Rehabilitation works at landfill site and old disposal site	1	6
3. Any supportive measures to establish small recycling factory	1	6
3. Management measures to facilitate activities of residents and business entities	1	6

**Question 7: What kind of support do you need for the formulation of M/P for your city?**

**Answer 7-1: From Central Government**

Opinions to improve this Workshop	Nos	%
1. To provide the provinces with consultation and guidance (manuals) in order for the provinces to formulate and implement their M/P (on-site and off-site)).	9	53
1. To provide the provinces with financial resources for purchase of new equipment and solution of SWM issues.	9	53
2. To support our province in building collaboration with ongoing projects and programs (Solve financing issues to formulate M/P within the framework of implementation of international programs and projects).	2	12

3. To provide provincial top officials with directions and guidance and to make them understand.	1	6
3. Amendments in Law on Household and Industrial Waste in order to improve legal environments; Law enforcement.	1	6
3. To monitor progress of M/P formulation and implementation activities	1	6
3. To enforce relevant articles of the Law on Household and Industrial Waste, National Waste Reduction Program and other regulations.	1	6
3. Organize trainings for relevant organizations and residents on formulation of M/P	1	6

**Answer 7-2: From JICA**

Program to be provided in the another Workshop	Nos	%
1. To conduct trainings and provide with guidance, information and methodological support	8	47
2. To send the JET to our province in order to provide us with necessary advice based on the local conditions/to organize training in provinces.	5	29
3. To cooperate with provinces on formulation of their M/P by means of providing financial consultative assistance.	4	24
3. To support provinces on conducting public education, preparation of PR tools and attracting residents participation	4	24
4. Provide with recommendations based on the investigations prepared by Aimags	2	12
4. Conduct survey at Aimag level	2	12
5. To evaluate the M/P formulated by provinces	1	6
5. To provide with necessary equipment (collection trucks)	1	6

**Question 8: What kind of support do you need for improvement of SWM in your city?**

**Answer 8-1: From Central Government**

Opinions to improve this Workshop	Nos	%
1. To provide with financial support for improvement of SWM, removal of illegal dump sites, purchase of fuel and equipment for landfill operation and preparation of PR tools for public education.	11	65
2. To provide with professional expertise required to improve SWM at aimag and soum level	2	12
3. To improve laws and legal environments	1	6
3. To conduct EIA	1	6
3. To set necessary amount in the provincial budget for landfill operation	1	6
3. To set higher waste fee for companies generating much waste (such as construction company and heating plants).	1	6

**Answer 8-2: From JICA**

Program to be provided in the another Workshop	Nos	%
1. To send the JET to check conditions of provincial landfill sites and provide them with necessary consultancy on-site	4	24
1. To provide with professional support, guidance and organize on-site and off-site trainings	4	24
2. To provide with financial support	2	12
2. To Implement JICA projects and programs to improve local SWM	2	12
3. To provide with training materials	1	6
3. To cooperate on implementation of PR activities for residents	1	6
3. To support introduction of 3Rs in our province	1	6
3. To cooperate with provinces on improvement of the provincial SWM	1	6
3. To provide with necessary equipment (collection trucks)	1	6
3. To establish a small-scale recycling factory in our province	1	6
3. To ensure the implementation of close cooperation up to the level when all SWM related issues are solved according to its required standards	1	6

## b. JET Evaluation

### b.1 Evaluation of the Answer made by the Participants

まず第1に、この Workshop は、Provincial City の廃棄物管理者が各市の廃棄物管理 M/P を策定する上で、非常に有用であったと評価する。回答者全員が Question 2 に対して、有用である (Yes) と回答している。また、Question 3: Workshop の 15 のプログラムについても、全てのプログラムに対して、82%以上の参加者が有用であると回答している。さらに、Question 4: どのような知識と経験を得られたかという質問に対して、71%の参加者が「M/P を策定するための知識と経験」、そして 59%の参加者が「人口予測やごみ量・ごみ質予測ができるようになった。」と回答している。

Question 5-2: 「参加者がこの Workshop に期待した知識は得られたか？」に対しても、全員が得られた (Yes) と回答している。期待した知識の具体的な内容 (Answer 5-1) も Workshop の 15 のプログラムにある内容であった。

Question 6-1: この Workshop に対する改善事項については、「参加者のうちのある Province を選定して Workshop を開催する」(24%)、「Workshop の期間を長くする。」(12%)などが指摘された。Question 6-2: 追加プログラムの要望については、「住民の意識、態度、教育の改善手法」(24%)、「有害廃棄物、医療廃棄物の処理技術」(12%)、「外国での廃棄物管理経験、特に Good Practice の紹介」(12%)などが指摘された。

Question 7: 各市の廃棄物管理 M/P を策定する上で必要な支援について、中央政府 (Answer 7-1) に対しては、「市に対して、廃棄物管理 M/P の策定のための相談や指導を行う。」(53%)、「市に対して、廃棄物管理問題の解決と新機材の調達のための財源を提供する。」(53%)などが指摘された。また、JICA (Answer 7-2) に対しては、「教育訓練の実施とガイダンスや知識や方法の提供。」(47%)、「JET を派遣し、各市の実情に応じたアドバイスを提供する。」(29%)などが指摘された。

Question 8: 各市が廃棄物管理改善を実施する上で必要な支援について、中央政府 (Answer 8-1) に対しては、「各市が廃棄物管理改善を実行するため必要な財政支援を行う。」 (65%)、「各市が廃棄物管理改善を実行するために必要な専門知識を提供する。」 (12%) などが指摘された。また、JICA (Answer 8-2) に対しては、「各市の処分場の状況を把握し、現場で必要なアドバイスを行うために、JET を派遣する。」 (24%)、「専門的な支援とガイダンスを行い、現場と教室での教育訓練を提供する。」 (29%) などが指摘された。

## b.2 Evaluation of the Workshop by the JET

### b.2.1 M/Pの策定に必要な知識・情報の取得

Workshop の第 1 の目的である都市廃棄物管理基本計画 (SWM M/P) の策定に必要な基本的な知識・情報を、参加した地方主要都市 (PC: Provincial City) の関係者が理解した。理解の程度を知るために、参加した PC にそれぞれの都市の SWM M/P の Concept の作成を求めた。この点に関しては、ウランバートル市 SWM M/P がどのようなものであるか理解し、それを参考にして自分たちの街の M/P の Concept を自らの手で作成し、Workshop の最後に 10 都市の M/P の Concept が紹介されたことから証明される。専門家の支援がある程度まで得られれば、それぞれの都市の M/P を策定することは可能であると評価する。

### b.2.2 廃棄物管理関係者ネットワークの構築

首都ウランバートル市をはじめとして、参加した地方主要都市 (PC: Provincial City) の全てが都市廃棄物処理に関して、多くの課題を抱えている。今回の Workshop でこうした課題を抱える実務者が、それぞれの課題をお互いに相談し、その改善策について意見を交換することができた。また MONET は、地方主要都市から廃棄物管理担当者を招聘するためにレター作成や電話連絡を行うなど積極的に研修開催に向けて活動した。さらに Workshop においては、中央政府機関担当者と地方主要都市の廃棄物担当者との交流も行われた。即ち、Workshop を契機にして、都市と都市及び中央と地方のそれぞれの廃棄物管理関係者間の情報交換のネットワークの礎が構築された。この事実は、今後各 PC がお互いに切磋琢磨して、それぞれの都市廃棄物管理事業を改善していくよい機会を得たものと理解する。またこのネットワークは、中央政府の廃棄物管理に関する諸政策を地方へ浸透させる上で、非常に有効に働くものと推察する。

### b.2.3 中央政府へのImpact

MONET を初めとする中央政府関係者は、諸外国の支援を頻繁に受け、セミナー・ワークショップ及び国外研修などを通じて、廃棄物管理に関する先進国の最新の知識と情報を十分に有している。こうした最新の知識と情報と、都市廃棄物管理を所管する地方主要都市 (PC) の廃棄物管理の現状には、大きな乖離がある。このグループ研修で PC の SWM M/P の Concept 策定などを、PC の担当者と共同で作業することにより、中央政府関

係者はこの乖離について相当に理解するようになった。このことは、廃棄物管理を実際に改善していく上で、より現実的な諸政策が中央政府関係者から示されることを期待させる。

#### b.2.4 MUB/EPWMD/CMPUAのリーダーシップ

MUB/EPWMD/CMPUA は、本技プロのみならず開発調査そして無償資金協力のカウンターパート (C/P) であったが、M/P の策定と実施に関してやや受身の立場にあった。しかしながら、この workshop においては、M/P の策定と実施に関して、これまで経験したものを、他の地方主要都市に対して積極的に伝達すると言う能動的立場に置かれた。

こうした立場からこの研修では、MUB/EPWMD/CMPUA は、モンゴルの地方主要都市のリーダーとして、非常に積極的にその役割を果たした。自ら担当する講義のみならず、グループ作業においては、他都市の関係者のために、パソコン操作等の作業を積極的に行い全体作業のサポートを行った。

### A.2.5 総括

今回の Workshop には、モンゴル全国の 10 の地方主要都市より 18 名の研修生が参加し、3 日間の研修をおこなったが、費用としては総額で約 14 万円程度であった。(UB 迄の旅費は各都市負担、会場費及び研修生の宿泊費補助) 研修生 1 人あたりの費用は約 1 万円以下と、従来の C/P 日本国内研修と比較して、非常に安価であった。

これに対して、研修効果は上述のように充実したものであり、今後地方主要都市が廃棄物の M/P 策定をすすめていくために、必要な基本的な知識と情報を取得できた。また、Workshop を通して、本技プロのみならず開発調査そして無償資金協力の成果を多くの人に理解してもらえたことや実務者レベルでの交流などの副次的な効果も大きなものであった。

これまでの技プロの中で行われる C/P 研修は、対象となっている C/P 機関の人を対象としてきたため、技プロの成果を C/P 以外の関係機関の実務者へ伝える機会が必ずしも十分に与えられなかった。今回の研修では、日本の援助を受けて廃棄物管理改善を進めているウランバートル市の関係者のみならず、本技プロのみならず開発調査そして無償資金協力の成果を利用してモンゴル全国の多くの廃棄物管理実務者に対して、廃棄物管理改善手法を学習する機会と知識・情報を与えられたことに非常に意義がある。今後ともこのような機会が技プロで設けられることを切に要望する。

### A.3 「ウ」市家庭から出る有害廃棄物とe-waste に関するセミナー資料

#### A.3.1 「ウ」市のe-waste 調査報告書

- a. 調査の概要
- a.1 背景

WEEEはWaste Electrical and Electronic Equipmentの頭文字をとったもので（しばしばe-wasteもしくはe-scrapともよばれている）、いわゆる廃棄された、余分な、古い、もしくは壊れた電機・電子製品のことを総称している。WEEEには鉛、カドミウム、ベリリウム、などの有害重金属を含無場合が多く、発展途上国におけるこれらWEEEの処理方法によっては、深刻な健康被害や環境汚染を引き起こす危険性がある。

先進国においても、これらWEEEのリサイクルや廃棄には、従事する作業員や地域に対してかなりの危険性が有り場合が多く、十分に安全な作業環境を確保する必要がある。

これらの背景の下、ウランバートル市においては、WEEEの処理・処分がどのように行われているかを調査し、今後のWEEEの処理・処分の方針を策定するための材料を提供することとした。

## a.2 目的

本調査の目的は、以下のとおり。

1. ウランバートル市における WEEE の廃棄、リサイクル、処分にかかわる現状を調査する
2. 「モ」国における WEEE のリサイクルフローを作成する。
3. 「モ」国における WEEE の適正な処理処分方法を推奨する。

## a.3 対象とするWEEE及び調査の範囲

当初は、テレビ、冷蔵庫、洗濯機、パソコン、携帯電話の5種類の電気・電子製品を対象に、調査を行う予定であったが、EPWMDと協議の結果、携帯電話については、その多くが韓国や中国から中古品が税関を通らずに持ち込まれているため、その数を把握することが困難であること、並びに「モ」国においては廃棄される数は極限られていると推定されることから、今回の調査対象からは外すこととした。

この調査の流れとしては、

- 各種製品の平均寿命をもって、EEEはWEEEになるものと仮定する。
- 従って、ある電気・電子製品（EEE）の平均寿命が10年とすると、10年前に輸入されたEEEが今年WEEEとなって消費者からでてくるもの考える。
- WEEEとして市場にでてきたものは、修理されて再利用されたり、修理用の部品とりに使われたり、分解の後有価物として引き取られたりするが、それぞれの段階での割合を明らかにする。

従って本調査においては、修理店に持ち込まれて修理されたEEEやそのために交換されたパーツなどは含まないものとする。

## a.4 調査方法

### a.4.1 データの収集

データ収集のため、JETはEPWMDと協力して、聞き取り調査並びに、質問票調査を実施した。その概要は以下の通り。

#### 聞き取り調査

この調査の目的は、対象とするWEEEがどのように市場に出てき、リサイクル、処分されているかを概略調査することにある。JETはCPと協力して、WEEEのリサイクルに携わる5つの事業者と、15人の個人商店に対して聞き取り調査を実施した。聞き取り相手は、家電製品の修理店、冷蔵庫リサイクル店、個人の修理屋、ウェストピッカー、ごみ収集人、金属古買商とした。

### 質問票による調査

上記聞き取り調査の結果、リサイクル業者などは、回答を渋るケールが多く、データの収集が困難であることが判明したため、EPWMDと協議し、質問票を作成した後、リサイクル業者などを監督する各区のPSDを通して配布し、後日回答を回収することにした。

質問票の内容は、それぞれの部品のうち、リサイクルする部品と廃棄する部品、リサイクル量、リサイクルの方法、取り扱うEEEの種類などに関するものとした。（添付質問票参照）

#### a.4.2 収集データ分析の条件

収集データの分析に当たっては、以下の条件を適用した。

1. WEEEの数量を表現するに当り、重さ（KgもしくはTon）を利用した。
2. 「モ」国においては、電気・電子製品の製造業は存在しないため、2009年にそれぞれそれぞれの製品の平均寿命を終えるEEE（平均寿命年数前に輸入された数量）をもって、2009年のWEEEの総数量とした。
3. 各EEEの平均寿命は、「モ」国での統計値が得られなかったため、日本における平均寿命と同じと仮定した。
4. 調査サンプル数には限りがあるが、調査した段階で得られた各種処理の割合をもって、「モ」国全体のWEEEの処理フロー全体を推計した。

#### b. ウランバートル市におけるWEEEリサイクリングシステムの現状

聞き取り調査の結果、WEEEのリサイクルの方法は、WEEEのタイプにかかわらず同じであることが判明した。

##### b.1 リサイクル可能な部品と廃棄する部品

聞き取り調査の結果、リサイクル可能な部品と、その他部品は、WEEEの種類によって以下の通りであることが判明した。

図 A-2: リサイクル可能な部品とその他

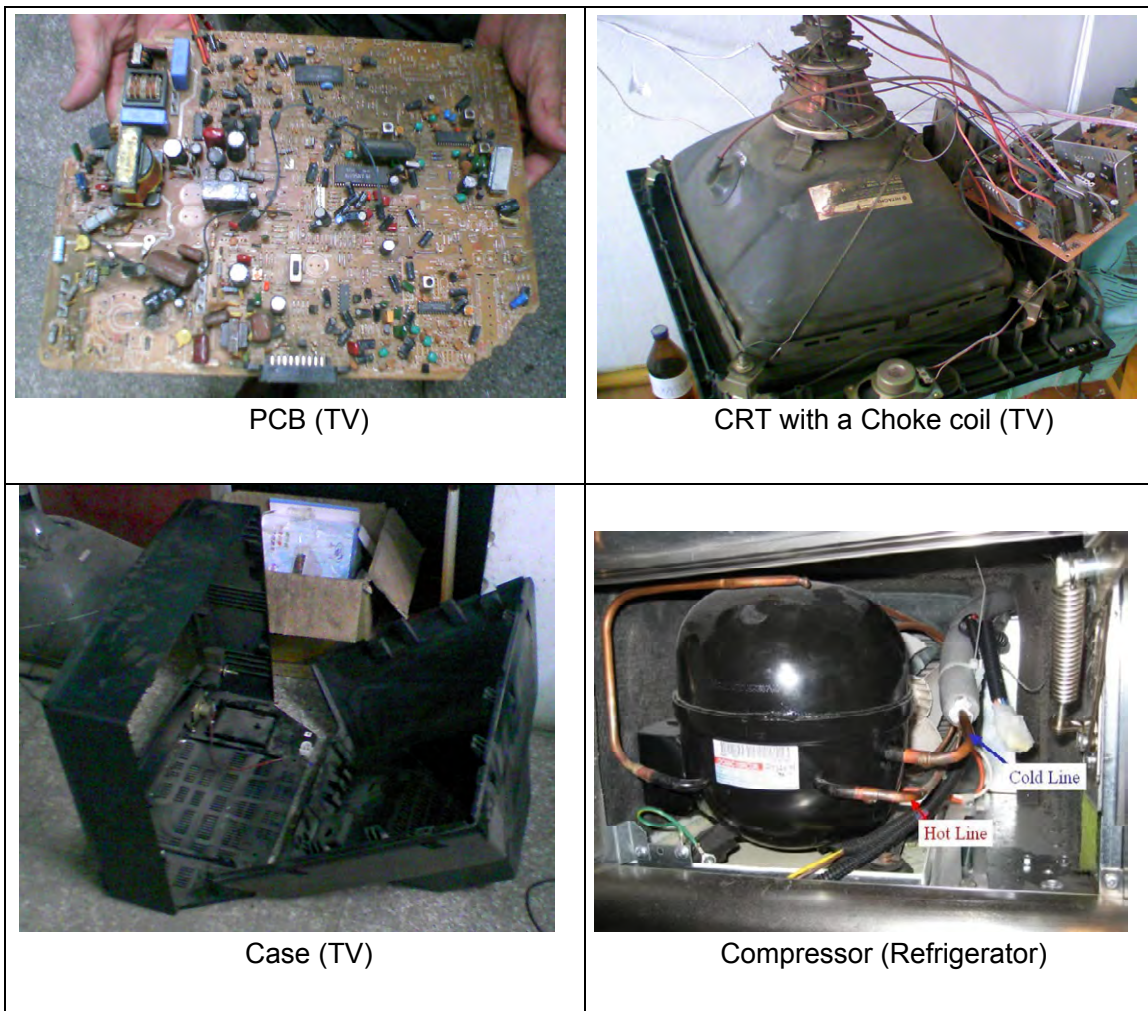
	TV sets	Refrigerator	Washing machine	PC
Recyclables:	PCB	Compressor	Compressor	Main board items
	Choke coil	Iron cases	Iron cases	Some functional parts
	Wires	Wires	Wires	Power supply unit
				Processor case
				Wires
Non-recyclables:	CRT	Rubber items	Plastic items	CRT monitor
	Plastic cases	Glass		Optical drives

		Plastic		Floppy drive
				Plastics & mixed items


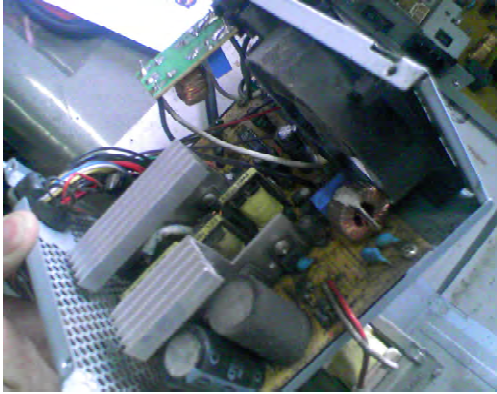
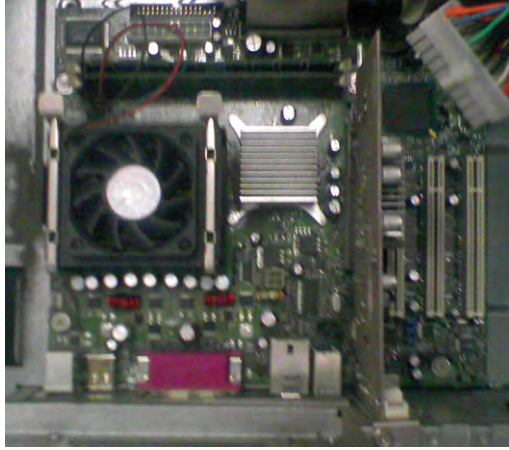

リサイクル可能な部品の大部分は、金属を含む部品であることがわかった。一般的に金属を含む部品は、壊れていようとも分解することによって金属として有価で売却できるため、リサイクルルートに乗りやすいという特徴がある。

非金属部品ならびにその他小さな部品に関しては、壊れていない場合は修理のスペアパーツとして分解保管されるが、実際に使用されるか否かはその時の需要供給の市況による。その他金属を含まない部品については大部分が廃棄処分となるが、パソコンのメインボードに関しては、将来的に再利用されることを期待して、リペアショップで保管される場合が多い。

図 A-3: WEEE から分解された各種部品





 <p>Motors (Washing machine)</p>	 <p>Power Supply Unit (=PSU; PC)</p>
 <p>Main board (PC)</p>	 <p>Wires</p>

## b.2 WEEEのリサイクルプロセス

「ウ」市におけるWEEEのリサイクルプロセスの特徴として、まず大部分が再利用にまわっていることがあげられる。リサイクルショップを調査した結果、中古として購入された電気・電子製品は、その大部分が修理されたり、そのままクリーニングするだけで中古品として売却されていることが判明した。

従って、修理不可能なWEEEのみが分解され、部品取りや材料リサイクルにまわっている。分解されて取られた部品は、大部分がその業者によって再利用されているが、ごく少数は、その他業者に販売されるケースも見られた。

全ての金属（銅、鉄、アルミ、合金）は、冷蔵庫の外殻を除いて、中国に輸出されている。冷蔵庫の金属外殻は、ゲルストーブの煙突の材料として加工・リサイクルされ、「モ」国内で使用されている。

すべてのリサイクル業者によって、WEEEの分解は行われている。修理業者の場合も分解は行うが、TVの電線や、コンプレッサー、モーター、冷蔵庫の外殻などより多く金属を含む部品に限る傾向がある。

修理業者によって分解されたその他の部品については、ウェストピッカーや収集業者の作業員が、金属部分のみを分解している。金属部分に他の材料が含まれる場合は、売却価格が低くなるため、ほとんどのリサイクル業者は金属のみを分解して売却している。

残った残渣は、ごみとして収集されて最終処分場に運ばれている。

### b.3 WEEEをリサイクルする関係者

「ウ」市においては、WEEEをリサイクルする関係者として、修理店、個人の修理人、収集業者の作業員、ウェストピッカーや金属古買商などが存在する。

#### b.3.1 修理店ならびに修理屋

「ウ」市においては、修理店並びに個人の修理屋が、WEEEのリサイクルにおいて大きな役目をはたしている。なぜならかれらが消費者から直接故障したり古くなった電気・電子製品を買い取り、修理して中古品として販売したり、修理不可能な場合は、分解してパーツとりなどを行って行くからである。

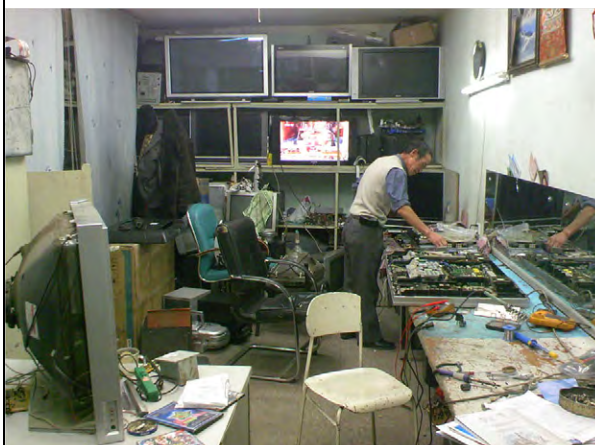
しかし「ウ」市における大規模な電気・電子製品の販売を手がける、NOMINデパートやMCSなどでは、古くなった電気・電子製品の買い取りは行っていない。従ってかれら大規模店が、WEEEのリサイクルに果たす役割は非常に限定的で、かれら自身の修理のために中古部品を利用するにとどまっている。

「ウ」市においてWEEEのリサイクルに大きな役割を果たしているのは、3人くらいの従業員規模の小規模のリサイクルショップもしくは個人で修理をやっている修理屋などである。特にTVや冷蔵庫の修理屋は、個人商店の場合が多い。

いくつかの種類の家電製品を扱う修理店も存在するが、その数は非常に限定的である。



A refrigerator recycler at Narantuul zakh who repairs and resells old refrigerators.



A TV repair shop located in the central UB.

#### b.3.2 ごみ収集車の作業員及びウェストピッカー

修理店で分解され、リサイクル可能な材料とその他残渣に分けられた後、これら残渣は、店の外にあるゴミ箱に捨てられ、これのなかからウェストピッカーや収集車の作

業員がさらなる有価物の回収をしている。有価物は主に金属をふくむ部品をさらに分解して、金属のみを取り出し、街中の金属古買商に売却している。さらに最終処分場においても、ウェストピッカーによって、最後の金属が回収され、リサイクルルートにのっている。

### b.3.3 金属古買商

WEEEやその部品から回収された金属は、その全てが市街もしくは処分場近くにある、金属古買商によって買い取られ、その全てが中国に輸出されている。買い取られる金属の種類としては、銅、鉄、アルミ、合金などである。

### b.4 WEEEのリサイクルフロー

「ウ」市におけるWEEEのリサイクルフローは、以下のように流れていく。

- (1) WEEEの修理店による買い取り
- (2) WEEEの再利用（中古品として売却もしくは修理後売却）
- (3) 部品のみスペアパーツとして再利用（修理に利用もしくは部品単体で売却）
- (4) 修理店において第1次分解
- (5) ウェストピッカーもしくは収集車の作業員によって第2次の分解
- (6) 処分場による金属の回収
- (7) 回収物は中国に輸出、残渣は処分場に埋め立て

このリサイクルフローを図示すると以下の様になる。

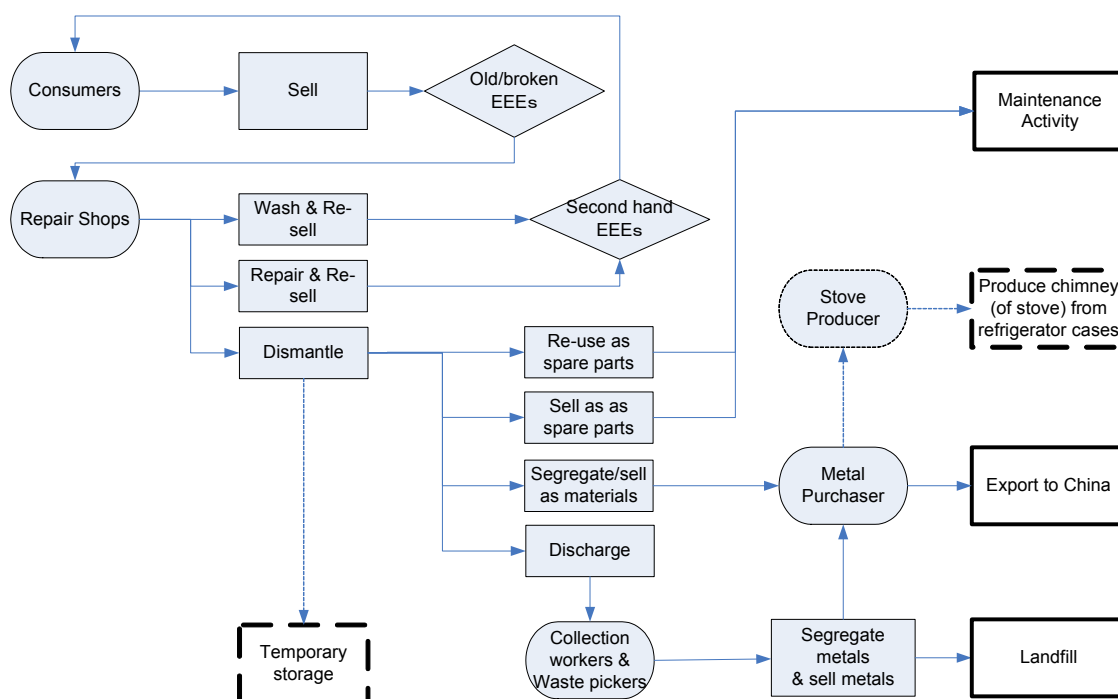


図 A-4: 「ウ」市の WEEE のリサイクルフロー

### c. 年間発生するWEEEの量

前述したとおり、年間発生するWEEEの量は、その製品毎の平均寿命と、過去にさかのぼった輸入量で推定することが出来る。但し「モ」国における各種電気・電子製品の平均寿命データは入手が不可能であったため、日本でのデータを使用することにした。平均寿命のデータと、「モ」国でこれら製品がWEEEとしてマーケットに出てくる数量を推定するための、輸入した年度を以下に示す。

表 A-4: 日本における各種電気・電子製品の平均寿命

	Items	TV set	Refrigerator	Washing machine	PC**
1	Lifetime period of EEEs (years)*	12	12	11	7
2	The year of necessary data for identification of WEEE amounts	1997	1997	1998	2002

\* Source (for EEEs except PC): Interview survey conducted by METI covering 4,700 households in 1997

\*\* Source (for Desktop PC): Interview survey conducted by Kokusai Kogyo (Thailand) Co., Ltd in 2003

上表に示すとおり、TV,冷蔵庫については、1997年の輸入量、洗濯機は1998年、パソコンは2002年の輸入量が、2009年にWEEEとなってリサイクルマーケットに流れてくると推定した。

そこで、それぞれの製品の各年度の輸入量を把握するために、General Custom Office of Mongolia(GCO)及び、UN Commodity Trade Statistics のデータベースを調査した。その結果は以下のとおりである。

表 A-5: 「モ」国における EEE の輸入量データ

Years	Imported Amounts										
	TV set			Refrigerator			Washing machine			Desktop PC	
	UN*	Customs Office**	Adapted Figure	UN	Customs office	Adapted Figure***	UN	Customs	Adapted Figure	Customs office	Adapted Figure
1997	18,467		18,467	963		4,032	3,899				
1998	16,549			4,032			3,748		3,748		
1999	17,997			3,576			5,136				
2000	25,173			5,460			5,799				
2001	22,460	22,430		4,736	4,736		8,262	8,262		43,892	
2002	N.A.	33,971		N.A.	4,438		N.A.	11,888		60,589	60,589
2003	#####	36,692		#####	6,100		#####	14,354		64,631	
2004	49,402	48,862		10,037	10,037		N.A.	23,439		75,558	
2005	41,140	41,074		5,198	5,198		N.A.	23,101		114,009	
2006	43,422	43,419		1,151	1,151		N.A.	31,493		224,695	
2007				32,375	32,476		N.A.	41,507		89,652	
2008				N.A.	35,182		N.A.	58,250		105,714	

\*Source: UN Commodity Trade Statistics Database, <http://comtrade.un.org/db/default.aspx>, accessed on 26 Feb 2010

\*\*Source: Statistical Analysis Department, General Customs Office, Jan 2010

\*\*\* As the figure for 1997 indicated in UN database is seemed as odd, the imported amount in 1997 for refrigerator has been assumed as same as that in 1998.

GCOのデータベースにおいては、2001年以前の輸入量は存在しないことが判明した。そこでUNのデータと比較したところ、2003年のデータを除いては、両者のデータにそれほど差異はないことがわかったため、調査対象のEEEの当該年度の輸入量は、UNのデータを利用することとした。

しかし冷蔵庫の1997年の冷蔵庫の輸入量に関しては、次年度に比べ、またその他製品の輸入量の推移に比べ、極端に少ないため、翌年1998年度の輸入量をもって、1997年の輸入量と仮定した。

#### d. 質問票回答の分析

JETは、EPWMDとDistrict Officeと協働で、質問票調査を実施した。その目的は「ウ」市におけるWEEEのリサイクルフローを明らかにし、各段階でどれだけのWEEEがリサイクルされているかその量を推定するためである。その結果は以下のとおり。

##### d.1 分析したサンプル

今までの聞き取り調査で、WEEEのリサイクルに関して大きな役割を演じているのは、修理店であることがわかったため、調査対象は各区にある電気・電子製品の修理店とした。（質問票は添付資料を参照）JETが市内にある2カ所の大型市場に対し、9箇所に質問票を配布し、EPWMDが各区当り18箇所にたいし質問票を配布した。以下にその回収結果及び、有効回答数を示す。

表 A-6: 質問票の配布と回収状況

Distributed Org.	Target areas	Number of Questionnaires		
		Distributed	Returned	Used for Analysis
JET	Narantuul	4	4	4
	Khar khorin	5	5	5
	<b>Subtotal</b>	<b>9</b>	<b>9</b>	<b>9</b>
EPWMD	BZD	18	18	11
	ChD	18	5	4
	SBD	18	18	11
	BGD	18	7	5
	KhUD	18	13	10
	SKhD	18	15	8
	<b>Subtotal</b>	<b>108</b>	<b>76</b>	<b>49</b>
<b>TOTAL</b>	<b>117</b>	<b>85</b>	<b>58</b>	

上表に示すとおり、117の質問票を配布し、85カ所から回答を回収し、その中から58を有効回答として分析に使用した。

有効回答の中には、数種類のEEEを取り扱っている店もあるため、製品別に、TVは27、冷蔵庫は16、洗濯機は12、パソコンは11カ所からの回答となった。

##### d.2 分析結果

###### d.2.1 前提条件

回答の分析に先立ち、以下の条件を設定した。

1. TVのPCB（Printed Circuit Board）は、6種類の部品から構成され、それぞれの重量は同じと設定した。
2. 聞き取り調査の結果を参考にし、TVのCRTについては20%がリサイクルされ、プラスチックケースについては10%がリサイクルされると設定した。

3. パソコンのCRTモニターについては、全て同じ14"サイズと仮定し、その重量は10kgと設定した。
4. 回答者がある製品のある部品をスペアパーツとして使用しているとの回答があった場合、その製品に関しては、全て同じようにリサイクルされると仮定した。
5. 各種製品の構成部品の重量については、国際航業が他の国で調査した結果を参考した。

表 A-7: 各種 EEE の構成部品の重量

TV set		Refrigerator		Washing machine		PC	
Parts	Weight	Parts	Weight	Parts	Weight	Parts	Weight
PCB	1.65	Compressor	8.96	Iron scrap	23.12	Iron scrap	3.46
Plastic case	2.06	Case	10	Plastics	6.42	Power Supply Unit	0.80
CRT glass	10.16	Radiator	8.74	Glass	0.83	Plastics	0.59
Copper	0.26	Rubber hose	0.03	Aluminum	0.77	Mother board	1.16
Electric wire	0.51	Plastic	7.16	Copper	0.55	Hard disk*	0.46
Other scraps	2.81	Glass	0.16	Rubber gasket	0.51	Optical drive*	0.44
		Aluminum (fridge)	1.22	Electric wire	0.31	Monitor	10.00
		Electric wire	0.2	Concrete	11.92	Keyboard	0.50
		Rubber gasket	0.62	Particle board	1.05		
		Styrofoam	3.28				
<b>Unit weight</b>	<b>17.45</b>	<b>Unit weight</b>	<b>40.37</b>	<b>Unit weight</b>	<b>45.48</b>	<b>Unit weight</b>	<b>17.41</b>

Source: Kokusai Kogyo (Thailand) Co., Ltd, Report for Survey on Electrical and Electronic Waste (Complete Version), 2004

#### d.2.2 分析結果

上記前提条件に基づき、WEEEのリサイクルフロー各段階における、製品、部品の重量及びその割合を計算した。その結果を以下に示す。

表 A-8: WEEE リサイクルフロー各段階における部品・製品の重量及びその割合

#	Basic parameters	Measure unit	TV		Refrigerator		Washing machine		PC		
			Weight	Share in the total	Weight	Share in the total	Weight	Share in the total	Weight	Share in the total	
1	Average unit weight of EEEs	kg	17.45		40.37		45.48		17.41		
2	Total amount of WEEEs	unit	181		111		40		28		
		kg	3158.5	100.0%	4481.1	100.0%	#####	100.0%	487.48	100.0%	
Re-use Amount:											
3	1 Resell amount	unit	40		39		2		0		
		kg	698.00	22.1%	#####	35.1%	90.96	5.0%	0.00	0.0%	
	2 Repair & resell amount	unit	81		50		27		8		
		kg	#####	44.8%	#####	45.0%	#####	67.5%	139.28	28.6%	
	<b>Sub total</b>		unit	<b>121</b>		<b>89</b>		<b>29</b>		<b>8</b>	
		kg	#####	66.9%	#####	80.2%	#####	72.5%	<b>139.28</b>	28.6%	
Dismantling Amount											
4			unit	<b>60</b>		<b>22</b>		<b>11</b>		<b>20</b>	
			kg	#####	33.1%	888.14	19.8%	500.28	27.5%	348.20	71.4%
	Recycle Amount by										
	1	1 Re-use as spare parts	kg	140.22	4.4%	92.1	2.1%	125.81	6.9%	28.39	5.8%
		2 Sell as spare parts	kg	12.91	0.4%	34.82	0.8%	0.00	0.0%	8.11	1.7%
		3 Segregate & sell as materials	kg	11.24	0.4%	375.2	8.4%	151.08	8.3%	35.93	7.4%
	<b>Sub total</b>		kg	<b>164.37</b>	5.2%	<b>502.12</b>	11.2%	<b>276.89</b>	15.2%	<b>72.43</b>	14.9%
	2	Temporarily stored spare	kg	<b>0.00</b>	0.0%	<b>0.00</b>	0.0%	<b>0.00</b>	0.0%	<b>5.80</b>	1.2%
	Discharge Amount										
	3	1 Discharged	kg	33.12	1.0%	30.08	0.7%	25.06	1.4%	72.49	14.9%
2 Landfill amount		kg	849.52	26.9%	355.94	7.9%	198.33	10.9%	197.49	40.5%	
<b>Sub total</b>		kg	<b>882.64</b>	27.9%	<b>386.02</b>	8.6%	<b>223.39</b>	12.3%	<b>269.98</b>	55.4%	

### d.3 WEEEリサイクルフロー策定のための指標

上記計算に基づき、各種EEE毎のリサイクルフロー格段階におけるその割合を以下の表に示す。

表 A-9: WEEE リサクルフロー各段階の割合

#	WEEEs at Recycling Stage	TV	Refrigerator	Washing machine	PC
1	<b>Total amount of WEEEs</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>	<b>100.0%</b>
<i>Re-used Amount:</i>					
2	Resell amount	22.1%	35.1%	5.0%	0.0%
	Repair & resell amount	44.8%	45.0%	67.5%	28.6%
	<b>Total Re-used amount</b>	<b>66.9%</b>	<b>80.2%</b>	<b>72.5%</b>	<b>28.6%</b>
3	<b>Amount of Dismantling</b>	<b>33.1%</b>	<b>19.8%</b>	<b>27.5%</b>	<b>71.4%</b>
<i>Recycled Amount by repair shops:</i>					
4	Re-use as spare parts	4.4%	2.1%	6.9%	5.8%
	Sell as spare parts	0.4%	0.8%	0.0%	1.7%
	Segregated metals	0.4%	8.4%	8.3%	7.4%
	<b>Total Recycled by Repair Shops</b>	<b>5.2%</b>	<b>11.2%</b>	<b>15.2%</b>	<b>14.9%</b>
5	<b>Temporarily Stored Parts</b>	<b>0.0%</b>	<b>0.0%</b>	<b>0.0%</b>	<b>1.2%</b>
6	<b>Amount Discharged by Repair Shops</b>	<b>27.9%</b>	<b>8.6%</b>	<b>12.3%</b>	<b>55.4%</b>
7	<b>Amount Segregated by WP and</b>	<b>1.0%</b>	<b>0.7%</b>	<b>1.4%</b>	<b>14.9%</b>
8	<b>Landfill amount</b>	<b>26.9%</b>	<b>7.9%</b>	<b>10.9%</b>	<b>40.5%</b>

\*WP-waste pickers; CW-collection workers. Metal containing parts discharged by repair shops. As WPs and CWs pick them up and segregate metals, this category of WEEE has been considered as those "segregated by WP and CW".