PAGE PARTNERSHIP FOR ACTION ON GREEN ECONOMY

Industrial Waste Inventory in Mongolia

UNEP

International Labour Organization

UNDP Empowered lives. Resilient nations.

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unitar United Nations Institute for Training and Research

The report is published as part of the Partnership for Action on Green Economy (PAGE) – an initiative by the United Nations Environment Programme (UNEP), the International Labour Organization (ILO), the United Nations Development Programme (UNDP), the United Nations Industrial Development Organization (UNIDO) and the United Nations Institute for Training and Research (UNITAR).

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Disclaimer

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- United Nations Industrial Development Organization (UNIDO)
- Asian Institute of Technology, Regional Resource Centre for Asia and the Pacific

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  - Mongolian National Chamber of Commerce and Industry
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  - Mongolian National Recycling Association
  - Global Green Growth Institute
  - Mayor's Office, Ulaanbaatar City
  - Mongolian Association of Leather Industry
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Abbreviations and Acronyms

AusAID	Australian Agency for International Development
BCRC	Basel Convention Regional Centre
C&D	Construction and demolition waste
UNEP	United Nations Environment Programme
ILO	International Labour Organization
UNIDO	United Nations Industrial Development Organization
UNITAR	United Nations Institute for Training and Research
UNDP	United Nations Development Programme
GI	Green Industry
JICA	Japanese International Cooperation Agency
MNRA	Mongolian National Recycling Association
MNCCI	Mongolian National Chamber of Commerce and Industry
MEGDT	Ministry of Environment, Green Development and Tourism
PAGE	Partnerships for Action on Green Economy
GDP	Gross Domestic Product
ODS	Ozone-depleting substances
POP	Persistent Organic Pollutants
UB	Ulaanbaatar
SWM	Solid Waste Management
WHO	World Health Organization

Executive Summary

The Partnership for Action on Green Economy (PAGE) was launched at the UNEP Governing Council in February 2013. PAGE is a 7-year programme deploying the joint expertise of five UN agencies – UNIDO, UNDP, ILO, UNEP, and UNITAR – to progressively assist a total of 30 countries in their efforts to embark on green economy pathways. UNIDO's contribution to PAGE focuses on green industrial policy advice and its implementation by engaging key stakeholders such as private sector, government, research and civil society practitioners.

Mongolia was the first country to join the PAGE initiative in November 2013, and in 2014, the initiative completed an initial report by taking stock of Mongolia's situation and also a green jobs mapping study. Modelling and policy inventory work is now underway to support a quantitative analysis of the impact and cost of the country's transition to a green economy.

The study analyses the role of industrial waste management and the recycling industry in Mongolia, taking into account the contributions of policy-makers, entrepreneurs, academics, international organizations (e.g. UNEP IETC), the Mongolian National Recycling Association (MNRA) and other industrial stakeholders. The report also elaborates on existing waste management policies e.g. regulation on segregation of recyclables and non-recyclable waste including the regulatory, mandatory and voluntary instruments along with the industrial waste management chain.

The report defines the eco-industrial park as an industrial park in which businesses cooperate with each other and with the local community in an attempt to reduce waste and pollution, efficiently share resources and help achieve sustainable development, with the intention of increasing economic gains and improving environmental quality.

In the wastewater sector, there are regulations on the discharge limits to industries. However, there is still much to do regarding regulatory and institutional mechanisms related to 3R or integrated water resource management in the water sector, in which wastewater is embedded. There are also issues in vertical integration and consequently decentralization of wastewater management, given the lack of coordination among different actors, and given the minor focus on wastewater within the overall framework of the water sector. There is also a gap between urban and non-urban areas, which is critical, given that the latter areas have potentially more hazardous wastewater due to the presence of industries (e.g. mining); compared to urban areas where the wastewater is mostly domestic in source.

Despite the end-of-pipe approach to wastewater management, Mongolia has a weak infrastructure base for wastewater treatment, especially in peri-urban and rural areas. There is also a lack of technologies and methods for wastewater reuse and recycling in both households and industries, which could help in alleviating the pressure on the capacity of sewer/drainage systems and wastewater treatment plants. There is also a gap between service provisions for wastewater and cost recovery for such a service, as well as a gap in horizontal (sectoral) integration, especially with the waste sector. As mentioned, the current focus of gaseous emissions management is on the energy sector, with minor priority for the waste sector, which, among others, is crucial for methane emissions. Integration specific to the mining/mineral extraction sector, a major sector in Mongolia (also for its solid, liquid and gaseous waste generation), is also lacking. The key gap in the legal and institutional framework for SWM is on integration, specifically the coordination between the strategic and operational levels of SWM (vertical), and the coordination between SWM and other relevant sectors such as environmental management and urban management (horizontal). SWM is ideally embedded within the greater contexts of environmental management and urban management, as seen in the relevant laws and regulations at the national level. However, in practice, these sectors are not coordinated, missing the opportunities of sharing resources and expertise towards improving SWM system in Ulaanbaatar City.

There is also a technology gap noted in terms of gaseous emissions mitigation in Mongolia, such as in cleaner energy sources and more environmentally sound technology. The principle of 3R available in the waste sector is also not taken advantage of in the technology development, such as resource recovery and reuse of gaseous by-products (e.g., heat, methane).

Given limited government subsidies, SWM in UB city is solely dependent on waste collection fees. Recently, Mongolia introduced a hazardous waste classification list that was approved by the Cabinet meeting of the Government of Mongolia, resolution no. 263 dated 29 June 2015 signed by Prime Minister and Minister of MEGDT.

Proposed recommendations in this report include involvement and participation of the private sector in the waste management system, particularly in establishing recycling industries; central and local government plays a very important role in raising awareness on green economy for different industry sectors, advocating green economy in industries to achieve sustainable development; promote educational activities to increase environmental and health awareness of the population in Mongolia; Policies/strategies at national and city level that will stimulate the creation of green jobs and facilitate the greening of the industry sector in addressing waste management; important policy actions that could be considered like providing economic incentives to encourage recycling and recovery. As a result, Mongolia has potential for the development of eco-industrial projects, particularly as Ulaanbaatar City is keen on providing land space for an eco-industrial park.

1. Introduction

1.1 Background of study

It has been reported that there is an urgent need for improving hazardous waste management in Mongolia, due to the fact that the country imports a substantial amount of second-hand goods from China, South Korea, Singapore and the United States. Thus, due to the short life-span of such products, hazardous chemical waste and e-waste may often be generated. In addition, there is other waste that is also generated due to the lack of a repair industry and the lack of spare parts for products with partial defects. To address this increasing waste issue, Mongolia has ratified several international treaties (such as the Basel, Rotterdam, and Stockholm Conventions), with national legislation being in force since 2000 and strategic plans for hazardous waste management (such as the National Programme on Decreasing Waste) also being set in place.

It has also been reported that the major waste streams that are causing concern to the country are municipal solid waste (MSW), industrial waste and hazardous waste. Even though policies and regulations do exist for these major waste streams, Mongolia needs to further improve its technical capacity for waste management. Further, it is observed that a responsibility system (of producers or waste generators) would be essential to ensure the contribution of more stakeholders towards waste management.

The Rio +20 Declaration - The Future We Want - has highlighted that green economy is an important tool for achieving sustainable development and, in paragraph 66, invites the United Nations, relevant donors and international organizations to support countries in their transition to greener economies, through sharing of tools, methodologies, experiences and policy advice.

In response to this call, the Partnership for Action on Green Economy (PAGE) was launched at the UNEP Governing Council in February 2013. PAGE is a 7-year programme deploying the joint expertise of five UN agencies – UNIDO, UNDP, ILO, UNEP, and UNITAR – to progressively assist a total of 30 countries in their efforts to embark on green economy pathways. The collective endeavour focuses on mobilizing social awareness and providing specialized training to identifying critical bottlenecks, formulating and assessing policy options, and enabling policy implementation for the goal of greening the economy. UNIDO has a long track record in implementing cleaner production technologies at the national level, as well as providing evidence-based policy advice to member states. Thereby, UNIDO's contribution to PAGE focuses on green industrial policy advice and its implementation by engaging key stakeholders such as private sector, government, research and civil society practitioners.

Mongolia was the first country to join the PAGE initiative in November 2013, and in 2014, the initiative completed an initial report by taking stock of Mongolia's situation and also a green jobs mapping study. Modelling and policy inventory work is now underway to support a quantitative analysis of the impact and cost of the country's transition to a green economy.

Mongolia has committed to transition to a green economy, with the Ministry of Environment and Green Development and Tourism (MEGDT) being created as a core government body in 2012. In June 2014, Mongolia's Minister of Environment and Green Development and Tourism, Ms. Sanjaasuren Oyun, was elected as the first president of the UN Environment Assembly, the UN's highest body addressing global environmental issues. At the "National workshop for awareness raising and capacity building, which was held in February 2015 for the formulation of the National Waste Management Strategy in Mongolia"; the Ministries´ stressed high priority to Waste Management.

As part of the inception phase, the Industrial Waste Inventory forms part of the national PAGE steering committee work plan 2015 for Mongolia.

1.2 Objectives and Approach

The Industrial waste inventory was undertaken by the AIT RRC.AP[1] in coordination with UNIDO.

The scientific study analyzed the role of industrial waste management and the recycling industry in Mongolia, taking into account the contributions of policy-makers, entrepreneurs, academics, international organizations (e.g. UNEP IETC), the Mongolian National Recycling Association (MNRA) and other industrial stakeholders. The work of the RRCAP directly fed into the Industrial Waste inventory process in Mongolia.

The aim of the project was to provide an overview of the national waste management activities and identify the most promising areas of intervention, to build a base for the development of a national waste strategy. Thus, the inventory needed to go beyond descriptive analysis of the status quo, identifying the gaps and opportunities in the country's waste management framework. Furthermore, the study helped mobilizing stakeholders to contribute with ideas and get involved in the design and formulation of key policies to stimulate the establishment of a circular economy, eco-industrial parks and new waste clusters in Mongolia.

Following the PAGE approach, the task included the harmonization of existing studies and tools of the PAGE partner agencies and other assessments. The results of the IW inventory will be presented and discussed at a validation workshop in Mongolia.

The outcomes of the inventory will be used for the development of performance indicators, training programmes and capacity building measures, as well as provide lessons learned and, if applicable, best practice examples. Furthermore, Mongolia being the first PAGE country, for which an Industrial Waste inventory was conducted, the study needed to develop a methodological framework and provide recommendations on how the process of conducting such inventories for future PAGE countries could be improved.

A final report emanating from the inventory will be made available to national stakeholders and PAGE partners, and will form part of a global dialogue on industrial waste management and green policy.

Activities undertaken by RRCAP are implemented in collaboration and cooperation with relevant stakeholders in Mongolia and following the guidance of UNIDO, the other PAGE partners and actors.

The detail of the field survey report for IWI in Mongolia undertaken by AIT RRC.AP is in Annex 1.

1.3 Definitions

This section provides the definitions of waste and the definitions of type of waste streams.

Waste is defined as an unwanted by-product of human activity in solid, liquid, and gaseous form.

1 The Regional Resource Centre for Asia and the Pacific (RRC.AP) is an institute-wide, multi-disciplinary centre of the Asian Institute of Technology (AIT) with a goal to provide resources for policy setting towards sustainable development, acting as a science-policy interface by regional networking, processing and assessing information and knowledge for governments, local communities and other stakeholders in the Asia-Pacific region. The centre is located within the campus of AIT at Pathumthani province, north of Bangkok, Thailand.

Municipal Waste

Depending on the administrative boundaries, municipal waste may cover only residential and commercial non-hazardous waste, and may also include industrial and agricultural non-hazardous waste. This has to be defined based on the existing regulations and practices within the specified geographic location.

Residential Waste

Residential waste generated by households living either in single-family houses or multi-family buildings may contain organic waste (for example, from the kitchen and gardens), recyclable waste (for example, plastics, paper, cans, etc.), non-recyclable waste (that has no recycling value), and hazardous waste (batteries, some oils, etc.).

Commercial Waste

In many places, non-hazardous commercial waste generated by the businesses is considered as municipal waste; however, waste generators through private sector usually arrange its collection. The local authorities may provide the details of the types of commercial wastes to be considered as municipal waste.

Construction and Demolition (C&D) Waste

In some countries, construction and demolition waste is considered as municipal waste; however, the generator is responsible for its transportation to municipal landfill site. In many cases, the local authorities charge extra fees for the disposal of this waste. This waste could be substantial in volume; thus, may create challenges for municipal disposal facilities. There may be some hazardous substances in C&D waste and those should be disposed off separately.

Industrial waste[2]

Industrial waste is categorized as hazardous waste and non-hazardous waste. Usually, industrial waste is not considered as municipal waste; however, in some places, nonhazardous waste is disposed off at municipal disposal facilities. In this case, the industries make arrangements for the transportation of the waste to the disposal facility and they may pay disposal charges. The municipality should clearly identify its role in industrial waste management as per the regulations and current practices. This would help towards quantification and characterization of different types of industrial wastes with respect to hazardous and non-hazardous, and municipal and non-municipal wastes.

Hazardous Waste (Industrial, Healthcare and Laboratory, and C&D)

Hazardous waste is generated by different sectors including industries, healthcare facilities, laboratories, construction and demolitions, sludge and urban agriculture. Some hazardous waste is also generated by residential sector; however, the data on residential hazardous waste is usually collected under municipal waste. For hazardous waste, the data could be collected based on the classification of hazardous waste which is based on the content of hazardous substances.

2 UNEP Integrated Solid Waste Management Training Manual - Volume 1

2. National Waste Management

This section provides brief data and information on the socio-demographic characteristics, cultural, environment and economic features, particularly in identifying economically important industries in Mongolia.

Demographic and administrative units

Mongolia has a territory of 1,564,100 km². In 2014, the population density was 1.9 persons per km² in the national level and 289.9 persons per km² in the Ulaanbaatar city. Geographically Mongolia is located in northeast Asia region. Administratively, there are 21 Aimags [provinces] which are in turn divided into 329 Soums [districts] in Mongolia. The biggest lake - Uvs covers 3,574.8 km². The longest river is Kherlen 1,163 km long.

Figure 1 Territorial and administrative units in Mongolia
Source: Mongolian Statistical Yearbook, National Statistics, 2014 page 13

Population

The total population of Mongolia in 2014 was 2,995,900, increasing by 65,600 or 2.2 % compared with year 2013. The number of live births reached 82,839, from which 1,124 or 1.4 % were born abroad and 81,715 or 98.6 percent were born in Mongolia.

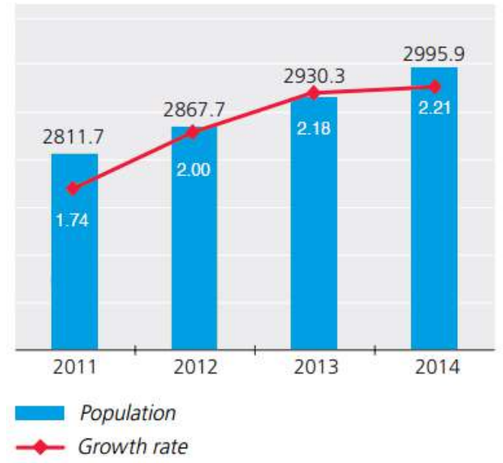

Figure 2 Number and annual growth rate of population in Mongolia

Capital City in Mongolia

Ulaanbaatar (UB) is the capital city of Mongolia, and is the political, economic and cultural center of the country. It was founded in 1639. The city is divided into nine (9) districts, namely: Baganuur, Bagakhangai, Bayangol, Bayanzurkh, Chingeltei, Khan Uul, Nalaikh, Songinokhairkhan, and Sukhbaatar. Each district is further subdivided into khoroos or sub-districts.

Figure 3 Location map of Ulaanbaatar city
Source: Google Maps

Ulaanbaatar city is situated in the foothills of the Khentii mountain range. It is situated in the valley of the Tuul River, which flows from east to west in this location. Mountains and hill slopes define the northern (Chingeltei Uul) and southern (Bogd Uul) limits of the city. There are also mountains to the east (Bayanzurkh Uul) and west (Songino Khairkhan Uul), but the river valley and its tributaries provide some open land in these directions.

Climate conditions

Aside from Population which is one of the key components analysis, climate change patterns is also one of the needed data and information for the preparation of any plans and inventory as this may affects seasonal changes in the generation of wastes from different industrial sectors.

Ulaanbaatar experiences an arid continental climate and has four distinctive seasons: summer, autumn, winter and spring. The summer extends from June to August when the average temperature is 15°C. Snowfall starts intermittently towards the end of the autumn. Winter extends from December to the end of February and is mostly cold with the average monthly temperature in February being –19°C. The minimum temperature reaches –40°C during this period. The rainy season is from June to August, when about 74 percent of the annual rainfall occurs. The average annual rainfall for the last 20 years is 267 mm.

Socio-Economic Information

Urbanization in Mongolia has developed sharply since the second half of the last century and the percentage of people in urban areas from the total population has been increasing. For instance, the population of Ulaanbaatar city as of 2011 is 1.3 million, accounting for about 46% of the total population of Mongolia (Figure 2). Migration, especially, towards Ulaanbaatar has increased since 2000 due to natural disasters such as "gan" and "zhud" affecting herders in rural areas. Also, there are many stable and safe working opportunities in the city and urban areas that mainly attracts population and is expanding the urbanization process. Increasing population in UB City, driven by migration has also led to the crowding of the city. As of 2013, the population density in the said city is at 261.87 persons per square kilometer.

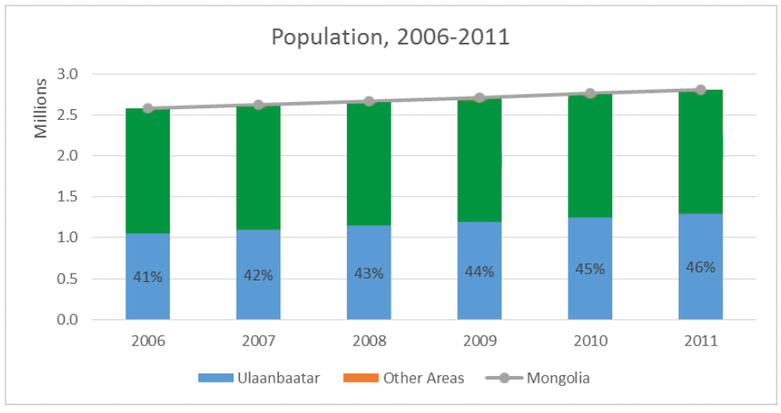

Figure 4 Population of Mongolia and UB City, 2006-2011
Source: Statistics Department UB, 2012

Since 1990, Mongolia has transitioned to a market economy. The economic development associated with the said transition has made Ulaanbaatar a center of science, culture, trade, services, industry and business of the country. In 2011, 70.0% of all companies officially registered in Mongolia are in Ulaanbaatar city while 64.2% of total companies run their operations in the capital city. The value of Ulaanbaatar city's economy was MNT 6.991 trillion by price of 2011, accounting for 64.6% of GDP of Mongolia in 2011. The economy of Ulaanbaatar city consists of services (68.8%), industry and construction (30.7%) and agriculture sector (0.4%). Weight of retail and whole sales, manufacturing, mining and quarrying, transportation and storing services is massive in the economy of Ulaanbaatar city.

Environment

According to the classification of unified land territory as of 2014, 73.5% of the territory in Mongolia is agricultural land, including 16.1% land for state special needs, 9.2% land for forest resources, 0.5%, for urban areas, including 0.4% land with water resources, and 0.3% land under roads and networks.

Table 1 Expenditure on Protection and Rehabilitation of Natural Resources

Types of activities	2011	2012	2013	2014
	mln.tog			
Total	**15 497.8**	**22 630.0**	**21 903.7**	**25 582.5**
Protection of nature	2 159.4	287.9	886.7	2 162.3
Environment protection fund	1 234.2	5 190.3	5 521.6	4 829.9
Protection of special protected areas	2 738.2	4 219.0	5 136.5	6 637.8
Reforestation, forestry activities	4 992.3	5 790.6	5 221.1	4 253.9
Land protection and rehabilitation	886.0	230.0	287.5	485.4
Actions of environment protection and environmental inspector	3 487.7	6 912.2	4 850.2	7 213.2

Source: Ministry of Environment, Green Development and Tourism

Table 2 Land Degradation

	2011	2012	2013	2014
	thous.hectares			
TOTAL LAND DEGRADATION	**9 233.1**	**8 370.0**	**9 014.7**	**9 390.5**
Cultivated area	52.9	44.7	39.1	172.1
Pasture and other wood land	8 870.1	7 876.5	8 804.2	9 006.5
Cities, villages and other settlements	5.7	6.5	6.6	15.9
Forest resourses land	293.1	432.2	153.8	188.6
Water resourses land	0.2	0.2	0.5	0.5
Digged and damaged land	11.1	9.9	10.5	6.8
Due to geology exploration and prospecting	0.4	0.7	0.2	0.1
Due to mineral resourses exploration	9.5	8.0	8.6	5.7
Due to defence and security operation	0.3	0.2	0.0	0.0
Due to construction of buildings, cable, network, maintenance repair	0.1	0.1	0.1	0.2
Due to construction and repair of roads, transportation and communication	0.8	0.8	1.5	0.8

Table 3 Daily average concentration of Pollutants in Air of Ulaanbaatar

Indicators of air pollution	2014 I	2014 II-IV	2014 V-VII	2014 VIII-X	2014 XI-XII
	mg/m³				
Sulphur dioxide (SO_2)	0.061	0.030	0.004	0.006	0.034
Nitrogen dioxide (NO_2)	0.072	0.043	0.030	0.036	0.054
Carbon monoxide (CO)	2.185	1.206	0.468	0.642	1.453
Particulate matter (PM10)	0.384	0.195	0.107	0.147	0.221

Table 4 Maximum Allowable Concentration of Air Quality Standard

Chemical combinations	Daily average	Once upon max
	mg/m^3	
Sulphur dioxide (SO_2)	0.020	0.500
Nitrogen dioxide (NO_2)	0.040	0.085
Carbon monoxide (CO_2)	10.0	60.0
Particulate matter (PM10)	0.100	0.500

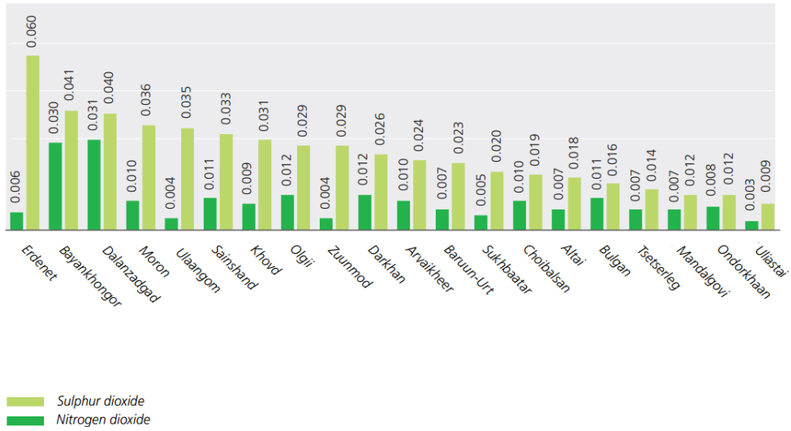

Figure 5 Annual average concentrations of pollutants in air of some Aimag centers, in 2014, mg/m3

Economy

In 2014, the Mongolian economy grew by 7.8%. GDP[3] per capital at current prices reached 7,403,400 tog and according to the World Bank Atlas method was 4,512 USD. In 2014, foreign direct investment reached 922.9 bln. tog, showing a decrease of 2278.2 bln.tog compared to the year 2013.

3 Gross Domestic Product (GDP) measures the sum of value added of all economic activities within the country's territory in a given year.

Table 5 Gross Domestic Product, by production approach, by classification of economic activities, at current prices*

Divisions	2011	2012	2013	2014**
GDP, mln.tog	11 443 578.4	12 853 406.6	14 350 689.2	15 464 801.5
GDP per capita, thous.tog	4 107.1	4 526.3	4 950.2	5 219.1
GDP per capita, by World Bank Atlas method, USD	2 639	3 045	3 425	3 218
GDP by divisions, mln.tog				
Agriculture, forestry and fishing	1 141 074.1	1 381 284.7	1 646 183.5	1 885 112.5
Mining and quarrying	2 263 685.0	2 452 170.4	2 905 821.9	3 608 003.7
Manufacturing	717 050.9	779 721.8	859 681.2	890 592.8
Electricity, gas, steam and air conditioning supply	203 113.3	213 226.6	224 762.8	238 097.2
Water supply; sewerage, waste management and remediation activities	31 895.3	31 546.1	33 316.8	33 003.0
Construction	307 022.3	568 837.4	614 243.5	620 351.4
Wholesale and retail trade; repair of motor vehicles and motorcycles	1 755 361.6	1 965 556.9	2 139 600.0	1 991 270.2
Transportation and storage	779 959.3	843 168.3	830 985.6	1 004 661.6
Accommodation and food service activities	66 691.1	75 799.7	79 564.6	72 000.4
Information and communication	270 470.9	314 311.5	361 096.2	381 611.1
Financial and insurance activities	357 442.1	509 020.8	666 031.1	818 765.2
Real estate activities	704 002.9	718 012.6	742 114.6	757 492.8
Professional, scientific and technical activities	133 824.7	135 340.1	146 013.4	158 503.4
Administrative and support service activities	82 570.6	84 320.2	87 608.7	98 940.5
Public administration and defence; compulsory social security	387 494.1	408 031.3	423 600.1	447 864.5
Education	383 028.4	387 349.7	392 361.5	398 559.9
Human health and social work activities	151 617.5	154 856.1	166 606.9	178 169.9
Arts, entertainment and recreation	28 320.8	28 904.7	30 302.3	32 025.8
Other service activities	52 414.7	57 562.9	62 043.2	68 003.1
Net taxes on products	1 626 538.8	1 744 384.8	1 938 751.2	1 781 772.5

*** Data benchmarked by results of Supply-Use Tables for 2011-2013.**

**** Preliminary results**

Table 6 Annual Change of Gross Domestic Product, by classification of economic activities*

Divisions	2011	2012	2013	2014**
	percentage			
GDP	**17.3**	**12.3**	**11.6**	**7.8**
Agriculture, forestry and fishing	-0.3	21.1	19.2	14.5
Mining and quarrying	7.7	8.3	18.5	24.2
Manufacturing	7.9	8.7	10.3	3.6
Electricity, gas, steam and air conditioning supply	6.8	5.0	5.4	5.9
Water supply; sewerage, waste management and remediation activities	2.2	-1.1	5.6	-0.9
Construction	22.7	85.3	8.0	1.0
Wholesale and retail trade; repair of motor vehicles and motorcycles	46.4	12.0	8.9	-6.9
Transportation and storage	15.1	8.1	-1.4	20.9
Accommodation and food service activities	26.7	13.7	5.0	-9.5
Information and communication	5.8	16.2	14.9	5.7
Financial and insurance activities	49.2	42.4	30.8	22.9
Real estate activities	2.4	2.0	3.4	2.1
Professional, scientific and technical activities	1.1	1.1	7.9	8.6
Administrative and support service activities	1.8	2.1	3.9	12.9
Public administration and defence; compulsory social security	-8.9	5.3	3.8	5.7
Education	0.8	1.1	1.3	1.6
Human health and social work activities	-9.3	2.1	7.6	6.9
Arts, entertainment and recreation	-11.6	2.1	4.8	5.7
Other service activities	17.9	9.8	7.8	9.6
Net taxes on products	62.9	7.2	11.1	-8.1

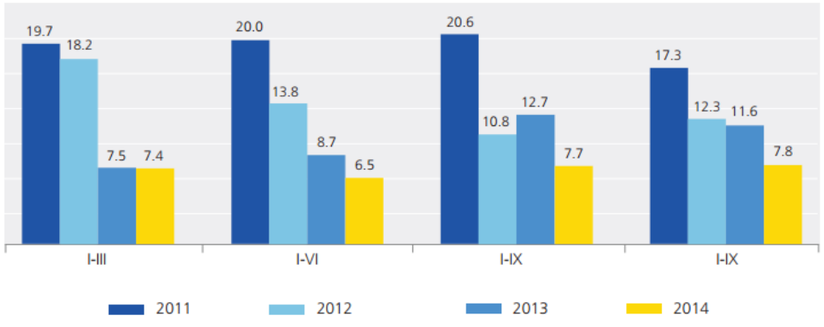

Figure 6 Annual change of GDP, by percent (by production approach, at 2010 constant prices, same period of the previous year)

Table 7 Industrial Composition of Gross Domestic Product, by classification of economic activities, at current prices*

Divisions	2011	2012	2013	2014**
	share to total			
GDP	**100.0**	**100.0**	**100.0**	**100.0**
Agriculture, forestry and fishing	10.2	11.2	13.4	14.0
Mining and quarrying	21.8	17.8	15.9	17.6
Manufacturing	8.6	9.0	10.7	10.6
Electricity, gas, steam and air conditioning supply	1.4	1.3	1.5	1.6
Water supply; sewerage, waste management and remediation activities	0.4	0.5	0.4	0.4
Construction	3.7	5.9	5.8	5.8
Wholesale and retail trade; repair of motor vehicles and motorcycles	22.1	19.9	18.4	16.4
Transportation and storage	6.2	5.2	4.3	4.5
Accommodation and food service activities	0.8	1.2	1.2	1.0
Information and communication	2.6	2.6	2.5	2.4
Financial and insurance activities	2.9	3.5	4.1	4.0
Real estate activities	6.8	5.8	6.2	6.1
Professional, scientific and technical activities	1.8	2.8	2.8	2.7
Administrative and support service activities	0.7	1.2	1.2	1.4
Public administration and defence; compulsory social security	3.9	4.2	4.1	4.0
Education	3.8	4.5	4.5	4.3
Human health and social work activities	1.5	1.9	1.9	1.8
Arts, entertainment and recreation	0.3	0.5	0.5	0.4
Other service activities	0.5	0.8	0.8	0.9

Table 8 Private Sector Value Added Share to Gross Domestic Product, by classification of economic activities

Divisions	2011	2012	2013	2014**
	share to total			
Share to total	**77.8**	**78.7**	**80.1**	**80.9**
Agriculture, forestry and fishing	100.0	100.0	100.0	100.0
Mining and quarrying	62.0	62.6	63.6	69.3
Manufacturing	95.8	95.8	97.0	97.4
Electricity, gas, steam and air conditioning supply	18.7	12.8	13.3	14.1
Water supply; sewerage, waste management and remediation activities	34.2	38.5	40.9	43.3
Construction	95.3	97.8	98.7	98.7
Wholesale and retail trade; repair of motor vehicles and motorcycles	99.7	99.7	99.7	99.7
Transportation and storage	66.6	64.3	66.6	64.5
Accommodation and food service activities	97.0	97.9	98.5	98.5
Information and communication	83.8	87.4	92.2	98.7
Financial and insurance activities	98.5	96.7	93.5	88.9
Real estate activities	99.8	99.8	99.9	99.9
Professional, scientific and technical activities	78.1	82.1	81.4	85.2
Administrative and support service activities	85.9	91.4	99.3	99.8
Education	14.0	19.9	18.0	19.2
Human health and social work activities	8.5	20.5	18.3	22.3
Arts, entertainment and recreation	20.3	24.3	25.7	30.5
Other service activities	98.5	99.0	99.0	99.5

Table 9 At basic prices, including a transformation into purchasers' Prices- 2011.

Industries	Agriculture, forestry and fishing	Mining and Quarrying	Manufacturing	Electricity, gas, steam and air conditioning supply	Water supply; sewerage, waste management and remediation activities
	mln.tog				
Б	1	2	3	4	5
Agriculture, forestry and fishery products	1 999 705.1	61 953.2	31.0	0.0	0.0
Ores and minerals	0.0	4 333 360.6	9 821.4	0.0	0.0
Electricity, gas and water	0.0	4 197.1	2 883.0	289 998.7	38 030.9
Manufacturing products	36 712.6	364 562.1	2 998 577.6	3.6	1 349.7
Constructions and construction services	0.0	463 159.3	9 252.6	1 951.9	411.6
Distributive trade services	0.0	6 187.9	11 135.8	1 164.9	20.7
Accommodation, food and beverage serving services	0.0	679.4	1 024.5	576.8	49.6
Transport and postal services	0.0	1 555.7	205.8	1.4	50.7
Electricity, gas and water distribution	0.0	9 343.8	2 883.0	378 887.7	51 554.3
Financial and related services	0.0	0.0	0.0	0.0	0.0
Real estate services; and rental and leasing services	218.3	4 310.4	4 975.7	339.6	88.6
Professional, technical and business services	0.0	402 051.0	1 844.4	203.1	0.0
Business and supporting services	10 668.9	32 529.0	61 552.2	3 906.9	50.2
Public administration and other services provided to the community; compulsory social security services	0.0	0.0	0.0	0.0	0.0
Education services	0.0	0.0	0.0	0.0	0.0
Human health and social care services	0.0	0.0	0.0	0.0	0.0
Sewage and waste collection, treatment and disposal and other environmental protection services	0.0	2 419.3	0.0	342.1	49 243.6
Services of membership organizations	0.0	0.0	0.0	0.0	0.0
Recreational, cultural and sporting services	0.0	0.0	0.0	0.0	0.0
Other services	0.0	0.0	0.0	0.0	6.0
Total	2 047 304.7	5 686 308.8	3 104 187.0	677 376.7	140 855.8
C.i.f./f.o.b. adjustments on imports	0.0	0.0	0.0	0.0	0.0
Direct purchases abroad by residents	0.0	0.0	0.0	0.0	0.0
OUTPUT at basic prices	2 047 304.7	5 686 308.8	3 104 187.0	677 376.7	140 855.8

Table 10 Investment, by financial sources and technological composition

Source	Investment, bln.tog				Percentage to total			
	2011	2012	2013	2014*	2011	2012	2013	2014*
Total	8 387.9	9 395.8	6 577.9	5 528.4	100.0	100.0	100.0	100.0
By financial sources								
Domestic	2 426.2	2 929.4	2 925.7	4 093.1	28.9	31.2	44.5	74.0
Central Government budget	1 110.5	1 427.9	1 236.6	1 506.5	13.2	15.2	18.8	27.2
Others	1 315.7	1 501.6	1 689.1	2 586.7	15.7	16.0	25.7	46.8
Foreign	5 961.6	6 466.3	3 652.2	1 435.3	71.1	68.8	55.5	26.0
Foreign direct investment	5 554.2	5 991.9	3 201.1	922.9	66.2	63.8	48.7	16.7
Foreign loan	245.5	260.8	326.6	368.9	2.9	2.8	5.0	6.7
Foreign aid	161.9	213.6	124.5	143.5	1.9	2.3	1.9	2.6
By technological composition								
Construction work	745.0	1 034.1	1 845.9	2 582.8	8.9	11.0	28.1	46.7
Residential building	222.2	336.3	741.9	1 140.1	2.6	3.6	11.3	20.6
Non residential building	204.2	360.0	348.1	633.8	2.4	3.8	5.3	11.5
General engineering construction	248.2	202.3	682.4	719.5	3.0	2.2	10.4	13.0
Capital repair and maintenance	70.4	135.5	73.5	89.3	0.8	1.4	1.1	1.6
Machinery and equipment	4 262.5	4 106.4	3 788.2	2 764.5	50.8	43.7	57.6	50.0
Transport equipment	1 703.0	1 581.3	1 403.9	940.7	20.3	16.8	21.3	17.0
Other machinery and equipment	2 559.5	2 525.1	2 384.3	1 823.9	30.5	26.9	36.2	33.0
Mineral exploration	398.5	585.8	225.3	83.2	4.8	6.2	3.4	1.5
Others	2 981.9	3 669.5	718.5	97.9	35.6	39.1	10.9	1.8

Table 11 Investment, by economic activities

Divisions	Investment, bln.tog				Percentage to total			
	2011	2012	2013	2014*	2011	2012	2013	2014*
Total	8 387.9	9 395.8	6 577.9	5 528.4	100.0	100.0	100.0	100.0
Agriculture, forestry and fishing	38.0	64.6	50.0	77.4	0.5	0.7	0.8	1.4
Mining and quarrying	5 195.5	4 694.5	3 031.5	799.4	61.9	50.0	46.1	14.5
Manufacturing	92.1	139.2	228.7	398.8	1.1	1.5	3.5	7.2
Electricity, gas, steam and air conditioning supply, water supply	207.0	171.6	199.4	328.0	2.5	1.8	3.0	5.9
Construction	990.7	913.8	802.8	1 010.6	11.8	9.7	12.2	18.3
Wholesale and retail trade; repair of motor vehicles and motorcycles	326.9	1 466.5	480.7	760.2	3.9	15.6	7.3	13.8
Transportation and storage	280.1	510.5	212.7	229.9	3.3	5.4	3.2	4.2
Accommodation and food service activities	30.5	20.1	17.7	74.3	0.4	0.2	0.3	1.3
Information and communication	91.6	156.2	388.5	351.4	1.1	1.7	5.9	6.4
Financial and insurance activities	227.2	168.3	216.0	150.5	2.7	1.8	3.3	2.7
Real estate activities	64.0	39.3	150.2	264.0	0.8	0.4	2.3	4.8
Public administration and defence; compulsory social security	373.6	429.1	401.8	469.5	4.5	4.6	6.1	8.5
Education	140.3	122.3	126.7	203.7	1.7	1.3	1.9	3.7
Human health and social work activities	29.8	43.5	57.5	96.8	0.4	0.5	0.9	1.8
Other service activities	300.6	456.4	213.5	313.9	3.6	4.9	3.2	5.7

According to preliminary estimates, Mongolia recorded a BOP deficit of 471.1 million US dollars in 2014. The capital and financial accounts recorded a surplus of 813.1 million USD, reflecting a decrease of 625.0 Tln. USD or 43.5% compared to the year 2014. This was mainly due to decrease of 1.6 bln. USD in the direct investment (net) compared to the previous year. In 2014, the total foreign trade turnover reached USD 11.0 billion, consisting of USD 5.8 billion for exports and USD 5.2 billion for imports.

Table 12 Main Exports Products

Commodities	Unit	2011	2012	2013	2014
Raw materials					
Greasy cashmere	t	2 829.5	3 597.8	4 070.2	4 035.4
Sheep wool	thous.t	8.4	4.5	2.4	7.4
Camel wool	thous.t	1.0	1.0	1.0	1.1
Horse mane	thous.t	400.8	301.2	329.0	453.6
Cattle hide	thous.p	.	4.0	140.5	174.5
Horse hide	thous.p	273.6	200.7	209.7	65.4
Sheep skin	thous.p	2.0	52.2	0.0	16.0
Edible meet offal	t	414.6	821.2	790.4	202.8
Crude petroleum oils	thous. barrel	2 553.7	3 568.0	5 243.8	6 885.1
Coal	thous.t	21 296.0	20 915.5	18 373.1	19 499.0

Processed, semi-processed products					
Copper concentrate	*thous.t*	575.9	574.3	649.8	1 379.0
Molybdenium concentrate	*thous.t*	4.2	4.3	4.0	4.0
Flourspar concentrate	*thous.t*	407.1	428.9	338.1	313.7
Refined copper & copper alloys	*thous.t*	5 802.0	6 415.9	6 724.5	6 324.7
Gold, unwrought or in semi-manufactured forms	*t*	2.4	2.1	2.2	6.3
Zinc concentrate	*thous.t*	2.6	2.8	7.6	10.0
Timber	*m^3*	121.2	140.9	130.9	99.4
Sawn wood	*thous.m^3*	-	-	0.5	1.6
Combed goat down	*thous.t*	0.5	0.5	0.6	0.6
Intestine	*t*	713.0	352.7	490.8	339.6
Meat	*thous.t*	10.6	3.1	3.0	2.3
Deer bone horns	*t*	9.0	4.0	5.0	18.3
Bonedust	*t*	2.3	0.0	0.4	28.3
Vodka	*thous.l*	48.5	13.4	137.0	53.0
Knitted or crocheted coat, jacket	*thous.p*	7.0	7.7	5.8	12.5
Knitted or crocheted underwear	*thous.p*	315.8	204.8	286.4	232.3
Knitted or crocheted sweater (jumper)	*thous.p*	99.0	132.2	96.7	102.6
Knitted or crocheted and gloves mittens	*thous.pairs*	16.0	11.9	20.8	18.2
Sewn coat, jacket	*thous.p*	8.3	0.2	0.1	0.7
Sewn underwear	*thous.p*	5.3	0.7	0.6	1.2
Carpets	*mln.m^2*	156.4	145.9	50.1	109.9
Blankets & travelling rugs	*thous.p*	7.3	5.7	5.0	4.6
Camel wool	*thous.p*	2.1	4.0	1.4	2.0
Waste products					
Iron scrap	*thous.t*	1.3	1.6	1.1	0.8
Lead waste & scrap	*thous.t*	0.6	0.1	0.4	0.5

Agriculture

Number of livestock reached 52.0 million heads for the first time in history, of which horse was 3.0 million heads, cattle was 3.4 million heads, camel was 0.3 million heads, sheep was 23.2 million heads, and goat was 22.0 million heads. The total crop of cereals was 518.8 thousand tons, 161.5 thousand tons of potatoes, 104.9 thousand tons of vegetables.

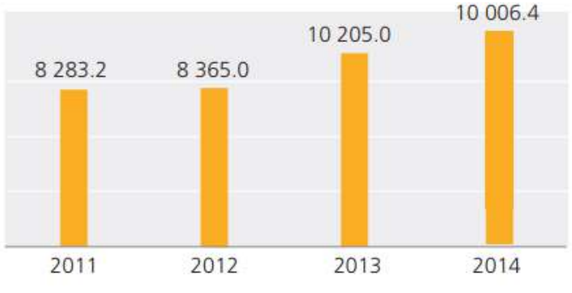

Figure 7 Livestock slaughtered for consumption, thousands heads

The livestock slaughtered for consumption has increased from 8.2 million in 2011 to 10 million in 2014 in Mongolia. These slaughtered livestock are raw materials for the meat processing industries.

Industry

This section provides statistics on the economic state of the industrial sector by number, size, expenditures, volume of production (real and price), sales and the main indicators of fixed assets and financing of establishments. These statistics are compiled by using the monthly and annual Establishment reports, census and surveys.

The gross output of the industrial sector at current prices amounted to 12,231.9 billion tugrugs in 2014. Compared with the previous year, the total production increased by 1788.2 billion tugrugs or 17.1 percent.

Mining and quarrying has a high percentage of contribution from 2011 to 2014 compared to the gross industrial output in Mongolia, followed by manufacturing.

Table 13 Production of Major Commodities

Commodities	*Unit*	2011	2012	2013	2014*
Hides large	*thous.t*	0.6	1.2	1.0	0.8
Goat skin	*thous.m^2*	1.3	1.6	1.9	1.7
Hide skin	*thous.m^2*	2.4	1.7	2.7	1.3
Leather boots, shoes	*thous.pairs*	9.1	18.3	26.5	49.3
Leather coat	*thous.pcs*	9.5	13.9	11.0	12.1
Leather jacket	*thous.pcs*	7.3	8.3	9.0	7.9
Skin coat	*thous.pcs*	22.5	9.0	16.8	14.2
Suits	*thous.pairs*	0.9	1.6	1.5	0.5
Stitched pants	*thous.pcs*	10.7	8.3	26.4	15.3
Stitched shirt	*thous.pcs*	13.0	14.4	133.1	8.4
Milk, dairy products	*mln.l*	55.4	72.8	63.9	71.1
Meat	*thous.t*	13.2	13.2	19.8	16.8
Canned meat	*t*	114.6	130.0	231.2	259.3
Kind of sausage	*t*	2 204.4	2 222.7	2 347.2	3 488.2
Salt	*t*	2 182.5	2 461.2	2 178.5	1 851.5
Fodder	*thous.t*	34.1	38.2	82.4	69.6
Small intestine	*thous.roll*	1 250.8	941.9	696.1	407.3
Spirit	*thous.l*	3 440.4	3 305.3	1 925.4	3 149.0
Alcohol, wine	*thous.l*	25 596.1	26 894.4	24 852.3	24 258.1
Beer	*thous.l*	57 133.6	65 124.6	63 775.3	67 740.7
Soft drinks, pure water, juice	*thous.l*	163 136.0	177 172.1	210 705.3	224 834.3
Flour	*thous.t*	105.3	115.3	246.5	239.6
Macaroni noodles	*t*	2 239.0	1 904.5	1 531.9	2 752.0
Bread	*thous.t*	23.9	25.4	25.0	30.2
Bakery products	*thous.t*	13.0	13.9	18.7	18.8
Biscuit	*thous.t*	0.4	0.6	0.5	0.5
Sweets	*t*	79.4	92.7	44.6	56.4
Cigarettes	*thous.blocks*	8 515.0	7 024.0	6 299.8	6 432.4
Book	*mln.pr.p*	47.5	60.8	55.5	62.5
Newspaper	*mln.pr.p*	40.8	69.2	55.9	39.5
Forms	*mln.pr.p*	8.7	14.7	14.9	11.6
Liquid medicine	*t*	2 426.0	2 579.3	3 699.9	3 159.1
Medical tablets	*thous.packs*	15 408.8	13 314.9	14 318.2	12 568.1
Mongolian medicine	*thous.tog*	45 704.9	57 971.9	73 554.0	127 253.7

Table 14 Some Industrial Production Per Capita

Commodities	Unit	2011	2012	2013	2014*
Thermal energy	Gkal	3.2	3.4	3.4	3.5
Coal	t	12.0	11.0	10.8	8.8
Crude oil	barrel	1.0	1.3	1.8	2.6
Copper, with concentrate	kg	191.7	189.5	287.6	375.1
Milk, dairy products	l	20.7	26.6	22.9	24.7
Meat	kg	4.9	4.8	7.1	5.8
Sausages	kg	0.8	0.8	0.8	1.2
Alcohol, wine	l	9.6	9.8	8.9	8.4
Beer	l	21.3	23.8	22.8	23.5
Soft drinks	l	60.9	64.8	75.5	78.1
Flour	kg	39.3	42.2	88.3	83.2
Bread	kg	8.9	9.3	9.0	10.5
Bakery products	kg	4.9	5.1	6.7	6.5
Cement	kg	158.9	127.9	92.7	142.8
Bricks made from clay	psc	11.9	16.3	23.8	20.4

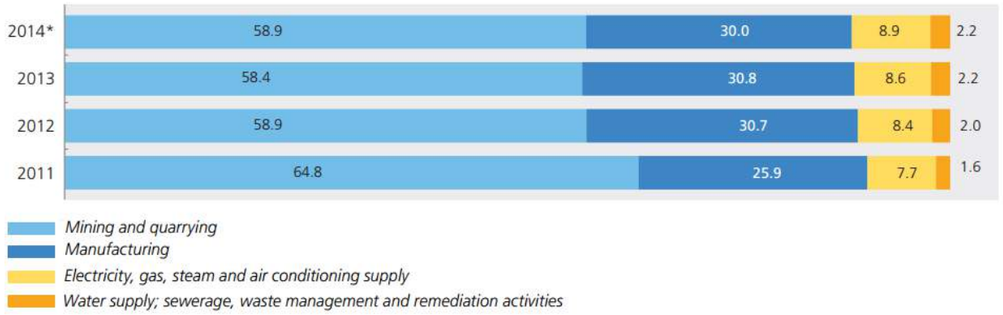

Figure 8 Composition of gross industrial output, by percentage

Industries that produce a high percentage of gross economic product include the mining and quarrying sector. Hence with this status, it seems these sectors also produce the most hazardous waste in the waste streams considering the sector use of chemicals and other hazardous substances to extract resources.

Registered Business establishment

In 2014, the Business Register Database registered 113,600 establishments, of which 59,800 establishments or 52.7% were operating actively. Among all active establishments 37,100 establishments or 62.0% were actively operating in Ulaanbaatar.

Table 15 Establishments, by legal status

Legal status	2011*	2012	2013	2014
Total	**67 409**	**90 538**	**99 603**	**113 602**
Company	53 142	74 336	82 904	93 512
State enterprise	260	314	308	395
Co-operative	1 755	2819	3 227	3 874
Partnership	2 051	2 461	2 537	2 835
Budget organisation	3 959	3 975	3 938	4 113
Non-Government organisation	5 879	6 312	6 468	8 587
Other (private kindergarten and schools etc.)	363	321	221	286

Table 16 Establishments, by division of economic activities

Sectors	2011*	2012	2013	2014
Total	**67 409**	**90 538**	**99 603**	**113 602**
Agriculture, foresty and fishery, hunting	3 514	4 765	5 360	6 374
Mining and quarrying	513	691	728	945
Manufacturing	5 853	7 425	8 044	9 188
Electricity, gas and water supply	239	280	320	381
Construction	4 226	5 430	6 529	8 940
Wholesale and retail trade, repair of motor vehicles, household goods	26 504	41 123	44 590	48 865
Hotels and restaurants	2 344	2 967	3 097	3 254
Transport, storage and communications	3 181	4 039	4 336	5 063
Financial services	2 167	1 754	1 839	2 069
Real estate, renting and other bussiness activities	6 573	8 951	10 251	11 642
Public administration and defence, compulsory social security	1 387	1 387	1 390	1 433
Education	3 016	3 186	3 293	3 598
Health and social work	2 771	2 993	3 114	3 472
Other community, social and personal services	5 104	5 528	6 698	8 353
Other	17	19	14	25

*** Based on Establishment Census for 2011**

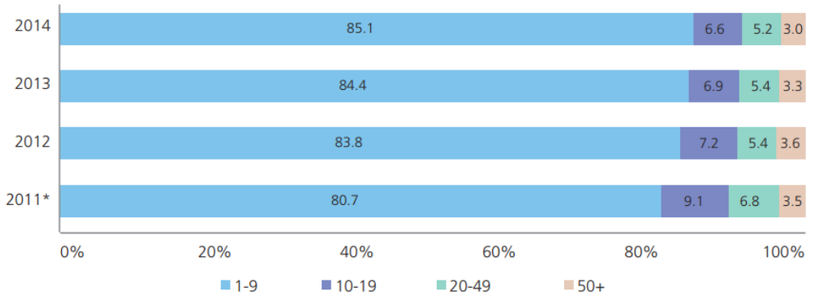

Figure 9 Number of active establishment, by employment size class, percentage share to total
[* Based on Establishment Census for 2011]

2.1 Waste Management

To address the waste stream, Mongolia has ratified international treaties (such as the Basel, Rotterdam, and Stockholm Conventions), while national legislation has been in force since 2000. Strategic plans for hazardous waste management (such as the National Programme on Decreasing Waste) are also in place. However, the responses suggest that a responsibility system (of producers or waste generators) would ensure the contribution of more stakeholders towards waste management.

As per the obligation of a party to the Basel convention, MEGDT organizes control and tracking trans-boundary transportation of hazardous waste together with the recipient country's Ministry in charge for environment. An example is Glori International LLC which had exported 3,000 tons lead acid battery disposal to Republic of Korea in 2006, under the control of both countries' ministries.

According to the "Law on Prohibition of Import, Transboundary Movement of Hazardous Waste and Its Export" the import of hazardous wastes for use, storage and final disposal in Mongolia is prohibited. In addition, transboundary movement of hazardous waste is fully prohibited.

The MEGDT, the State Professional Inspection Agency (SPIA), and the National Emergency Management Agency monitor hazardous wastes and enforce regulations. Three laws regulate hazardous waste management: the Law on Protection from Toxic Chemicals (1995), the Law on Transboundary Movement of Hazardous Wastes and Their Disposal (2000), and the Law on Industrial and Household Waste (2003). In spring 2012, the Parliament of Mongolia adopted a "New Law on Waste" combining the Law on Household and Industrial Waste and Law on Hazardous and Toxic Chemicals. The new Law has introduced 3R principles. In addition a Waste Reduction Action Plan was approved by the Government.

A number of rules and procedures have been enacted at Ministerial levels such as the "Regulation on classification, collection, temporary storage, transportation, treatment of hazardous wastes" (2002), "Regulation and procedures on disposal and landfill of hazardous waste of business entities, and requirements on waste containers and waste disposal sites"(2006), Methodology for calculating waste norms"(2006), "Payment calculation methodology for hazardous waste"(2006), "Classification and characteristics and hazard level of waste" with joint order No. 324/318/336 of Ministers for Environment, Health, and Education, Culture and Science (2006), "Regulation on labelling hazardous waste"(2006), as well as "Regulation on national reporting and inventory of hazardous waste"(2009).

Although there are adopted legislations for hazardous wastes, there are no disposal sites and treatment facilities for hazardous waste in Mongolia. Although the establishment of a disposal site of toxic and hazardous waste has already been issued by Municipality Governor, the project is still waiting for financing. Moreover, MEGDT is responsible of creating a database on hazardous and solid waste, but current inventory on sources of hazardous waste to define volume of generation under specific categories is also pending.

The economic development that accompanied Mongolia's transition to a market economy has resulted in an increased consumption especially in urban areas, and consequently increased solid waste generation (Figure 10).

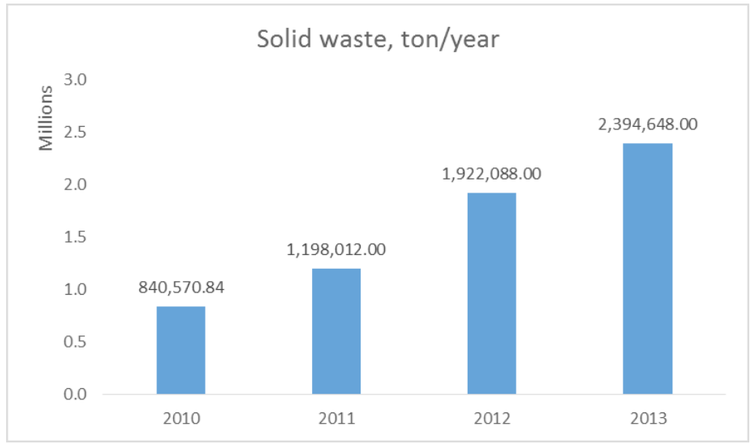

Figure 10 Solid waste quantity in Mongolia, 2010-2013

Solid waste generation in Mongolia is increasing yearly, with the amount in 2013 totalling 2,394,648 tons per year.

The data on Solid Waste Composition of recyclable materials was updated by the MEGDT as shown in Table 17.

Table 17 Solid Waste Composition of recyclable materials [as of 2013].

Description	%
Paper and paper products	41
Glass and glass products	37
Plastics	10
Aluminum container and its products	2
Tire	0.7
Electronic waste	0.3
Others	9

Source: The State of Environment Report for 2013-2014

Meanwhile, the research carried out by the Municipal Governor's Office concludes that 2,500-2,800 tons daily and 1.04 million tons solid waste are produced annually in Ulaanbaatar by households, enterprises and industries. According to WHO survey results, each urban citizen produces 0.354-0.535 kg of waste a day (in winter each citizen in Ger district produces 0.920 kg and about 50% of them is ash).

Ulaanbaatar City produces an estimated 800 ton/day of solid waste with a growth of 30% per annum. There is no segregation at source. Three existing landfill sites have exceeded their capacity. Air pollution and water pollution is growing rapidly. There is growing public concern on the hazardous waste (hospital, chemical process, battery, engine oil) which at the present time is illegally dumped on public land.

Waste Characterization

Most of the solid waste is usually delivered to the disposal areas without any elementary classification. However, there are four categories of household waste that are critical for Mongolia [source: MEDGT]:

1. Glass bottle
2. Paper, cardboard
3. Household ash
4. Food, organic waste

All types of solid waste generated by households and industry are transported to the waste disposal area. Solid waste treatment has three main stages: collection, segregation, transportation, and disposal (Figure 11). Some forms of resource recovery, specifically collection of recyclables, also occur during these stages (Figure 11).

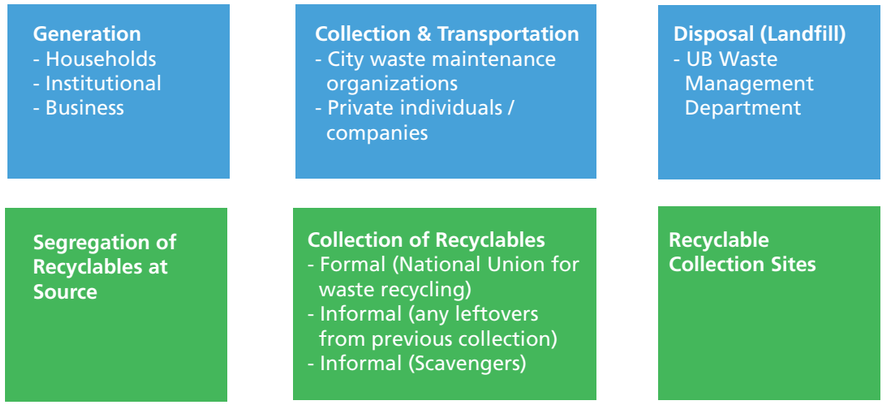

Figure 11 General flow of solid waste management in Ulaanbaatar city

The General Maintenance Company of each district is responsible for solid waste collection, transportation, and disposal. However solid waste is usually delivered to the disposal areas without any basic sorting. A company owned by the city is responsible for transporting the solid waste to the disposal area. There are some central disposal points in Ulaanbaatar City. Two of these process (Narangyn Enger and Tsagaan Davaa) almost 90-95% of the solid waste and they are located on the upper side of the city. However, their operation causes soil and soil waste pollution, smoke, ash and dust during the processing of waste and pollution of the environment. Only at the Ulaanchuluut site (UB's main garbage dump, northwest of 4th khoroo in Songinokhairkhan district) is the waste sorted for landfill.

Industrial wastes were not treated/collected differently from household waste, as both waste streams were mixed and sent to landfill. Some industries and institutions have their own treatment facilities due to hazardousness of the waste e.g. industrial hazardous substances and health-care wastes.

Existing infrastructure and technologies

Although there are some regulations on solid waste segregation and classification as illustrated in table 18, such as for health-care wastes, an official classification system for municipal solid wastes is yet to be established in Mongolia.

Recycling initiatives are almost non-existent due to a lack of recycling facilities within the country, excluding some small private businesses.

In 2012 there were 173 trucks registered for solid waste transportation in UB city, 30% of which were old trucks with outdated usage. Being handed down from foreign projects, some of these trucks are difficult to operate in Mongolia's harsh winter weather.

There are only two waste disposal sites/landfill near the city and several open field areas in UB city. Over the last 4 years, however, the Ministry of Environment and Green Development has invested in the following activities to improve local waste management issues. In order to improve the waste management system in UB city, 52 waste trucks with the cost of USD 6.5 million, MNT 850 million spent on landfill improvement in 2010. In 2011, MNT 4 billion was spent for trucks with multifunctional usage. In 2012, MNT 5.8 billion was spent on waste processing complex.

For Aimags[4] and local centers, MNT 1.3 billion was spent for waste treatment facilities on landfill sites in 13 aimags in 2011. In 2012, 867 million MNT spent in 20 aimags such as Umnugobi, Orkhon, Dornogobi and Bulgan, for the following purposes:

- Engraining habits on waste segregation, recycling for local people.
- Establishment of waste segregation points at the source.
- Cleaning of accumulated waste in local provinces and soums, [5]
- Establishment of central waste disposal site with a landfill

As a result of these measures, points for waste segregation were established in 5 aimags, and 1 new landfill site for waste disposal was created. According to a contract signed between the Aimag Governor and Minister of environment, it was a condition, that the Governor has a responsibility to plan their local budget for the waste management, proceeding with the work started by the Ministry's investment. Results of the local waste management work vary, as it depends on each Governor's effort on effective utilization of started investment.

4 Aimags refer to provincial administrative units, currently there are 23 Aimags in Mongolia. Please refer to figure 1 for geographical illustration of Aimag.

5 Soum refers to sub-administrative unit of Aimag.

2.2 Institutional Coordination

This section discusses the central government/national and local agencies and institutions responsible for waste management in terms of collection, transportation, treatment, recovery/recycling and disposal. The role of NGOs or associations like Mongolian National Recycling Association (MNRA) and the Asia Foundation is briefly discussed in this section.

The bulk of responsibility for solid waste management is decentralized at the district level, while the city government is responsible for landfill operations. Until 2007, the City waste management department directly managed the collection and disposal of solid waste in Ulaanbaatar. In 2007, a new regulation on waste management was introduced to minimize the city government's involvement, while increasing management efficiency. Under the current institutional arrangement, each district government is responsible for collection and transportation of waste from homes, business entities, and all other locations except for public spaces. The waste management department of each district collects fees, manages contracting services with a privately run waste collection and transportation company, and provides street cleaning services to citizens. The Waste Management Department of UB operates waste landfills and collects and transports waste in public places by contracting-out to the state-owned enterprise, UB Tuk.

Human resources capacity is reported as weak throughout the Mongolian civil service and positions are often left vacant or filled inappropriately. Those fortunate enough to benefit from academic and other training at great expense, often face disappointment on their return because many specialists finish up in inappropriate placements as their professional capacity is not recognized.

Another negative feature of the Mongolian civil service that has an impact on capacity is the change in deployment that takes place at all levels at each change of government. This is contrary to the Civil Service Law and contributes to a lack of continuity, misplacement of capacity, uncertainty and administrative inefficiency.

Personnel considered as working in the "environment" field are found in MEGDT, SSIA and Local Government. However, there are at least 13 Central Government organizations involved in some way with environmental administration and management or whose activities have a significant bearing on the environment, and some of these do have one or more positions that can be considered as working in "environment".

Each of the above 13 Central Government organizations has a role to play in the protection and management of the environment. However, Mongolian ministries and other agencies are established on a very strong sectoral and hierarchical approach with few if any mechanisms for coordination and less so, cooperation. The system is fragmented and instead of cooperation, too often there is competition.

In addition to its Head Office responsibilities, MEGDT also has a presence at the Local Government level. However, the situation at this level is complex, legislation is overlapping and confusing and responsibilities for environment are entangled and complicated. Aimag and capital city specialized inspection agencies have environment and infrastructure inspection divisions, and Soum Governors' Offices have Environmental State Inspectors. Aimag specialised inspection agencies have 3-4 Environmental Inspectors and Soum specialized agencies have one Environmental Inspector each.

The Aimag Specialized Inspection Units which come under the SSIA (see below), employ 379 Rangers and the Administrations of State Protected Areas have 211 Rangers. The role of MNRA is to coordinate with relevant stakeholders particularly the UB waste management department on recycling activities, in land fill.

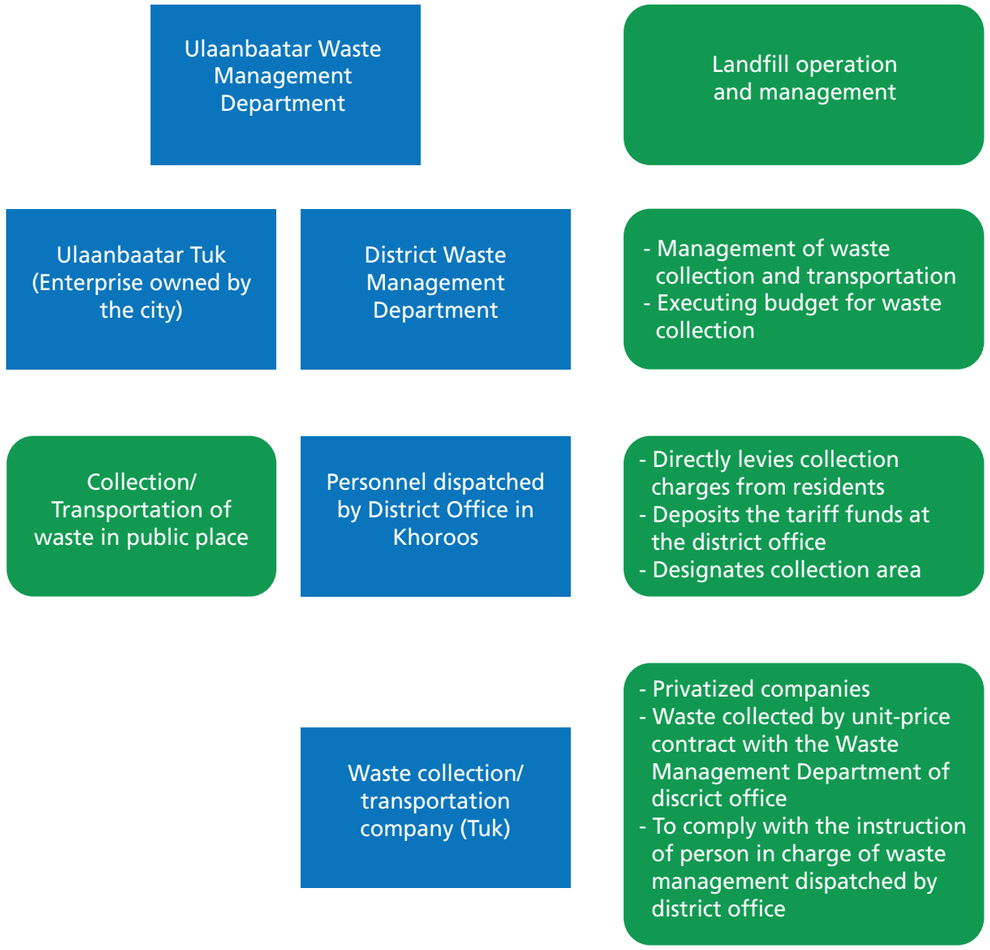

Figure 12 Institutional arrangement and responsibilities for Solid waste management in Ulaanbaatar
Source: The World Bank, Enhancing policies and practices for Ger Area Development in Ulaanbaatar

At Local Government level, environmental inspection functions are shared by different agencies and there is poor interaction and cooperation between them. SSIA Environmental Inspection Divisions do not report back to MEGDT on the results of inspection, the achievement of inspection works, law breaches or their implementation status. The interaction and cooperation between the MEGDT and the SSIA are unsatisfactory and neither MEGDT nor SSIA is working together on the prevention of breaches of environmental law together with local authorities. While there is a legal requirement on paper to allow the participation of citizens and their representatives, there are no guidelines or mechanism to make it happen.

The Ulaanbaatar City Charter, which comprises of the main charter and a comprehensive set of more than 50 sub-charters/codes that will govern the city's social, economic, political and cultural content. The Ulaanbaatar City Municipality has adopted and approved the City Master Plan 2030 on May 2015. The plan is the key document in guiding UB planning and activities including waste management sector. The current approved plan is in compliance with the national legal framework and in dissemination for public version of the Master Plan.

2.3. Waste management policies

This section elaborates on existing waste management policies e.g. regulation on segregation of recyclables and non-recycles waste including the regulatory, mandatory and voluntary instruments along with the industrial waste management chain.

The Law on Environmental Protection was enacted by the Mongolian Parliament in 1995 and the Government National Plan on Waste Reduction Management was approved in 1999. Table 18 lists the relevant laws and regulations on SWM in Mongolia.

Table 18 Related national laws and regulations on SWM in Mongolia

No.	Main Laws	
	Name	Year
1.	Hazardous waste list in Mongolia, Resolution no. 263 dated 29 June 2015 signed by Prime Minister and Minister of MEGDT	2015
2.	Law on Waste	2012
3.	Law on waste (combining Law on Household and Industrial Waste and Law on Hazardous and Toxic Chemicals, introducing principles of 3R)	2012
4.	Law on environmental impact assessment of Mongolia	2012
5.	A rule on classification, collection, temporary storage, transportation, treatment of medical waste	2011
6.	A rule on transportation of medical waste	2011
7.	Payment calculation methodology for medical waste	2010
8.	Law on Air pollution payment	2010
9.	Law on the Legal Status of Industry and Technology Parks	2009
10.	Regulation on national inventory and reporting of waste	2009
11.	Methodology for calculating waste norms	2007
12.	Payment calculation methodology for waste	2007
13.	Classification and characteristics and hazard level of waste with joint order No. 324/318/336 of Ministers for environment, health, and education, culture and science	2006
14.	Regulation on labeling hazardous waste	2006
15.	Regulation and procedures on disposal and landfill of hazardous waste of business entities, and requirements on waste containers and waste disposal sites	2006
16.	Law of Mongolia on hazardous and toxic chemicals	2006
17.	Law on payment of package and case imported goods	2005
18.	Methodology on registration and information of temporary storage, disposal of hazardous wastes	2003
19.	A rule on classification, collection, temporary storage, transportation, treatment of hazardous wastes	2002
20.	The Basel Convention on the Control of Trans-boundary Movement of Hazardous Wastes	1996
21.	Environmental Protection Law of Mongolia	1995

1, 2, 3, 4, 8, 9, 10, 11, 12, 13, 14, 17, 18, 19, 20, 21 [http://www.legalinfo.mn/law/];
5,6,7 [http://www.moh.mn/index.php?option=com_wrapper&view=wrapper&Itemid=162];
15 [www.legalinfo.mn/annex/details/5151];
16[http://resource1.sodonvision.com];

In 2015, also the concept on the "Eco- tax on imported goods" and "Regulation on classification, collection, temporary storage, transportation, treatment, recycling and disposal of hazardous wastes and the licensing" is planned to be developed. It is expected that these amendments and regulations will help to improve legal framework and capacity for the waste sector. There will be repealing of some existing regulations and methodologies.

The Ministry of Environment, Green Development and Tourism´s (MEGDT) mission is to direct economic-social growth toward the conservation and the balance of ecosystem while sustainable use of natural resources and provide rehabilitation of natural resources. MEGDT mandate to ensure the green development activities through environmentally friendly and sustainable development policies in the government, business and individuals organizations operation which empower human health and ensuring the right to live in a safe environment. In 2014, MEGDT has finished amendment drafts of regulations and methodologies as a legal framework improvement process for implementing waste management policy.

The Ministry of Mining´s mandate is to enrich mineral treasury of the nation, develop the mining sector, produce value-added products and boost socio-economic growth. Through the introduction of advanced and environmental friendly technologies safe living conditions are created, which aim to improve the quality of life of citizens.

The mandate of the Ministry of Industry is to plan, develop and implement long, medium and short-term policy of industry, trade and services area. This include provisions on sectorial economic growth via developing value-added networks and efficient use of the natural resources, and the development of industry to aim improve living standards of the nation. The Ministry of Industry was newly established in 2014. The ministry is responsible for the recycling sector, covering the recycling and packaging industries. The law on recycling in Industries developed by the ministry is now under approval by the parliament. Currently, there are 13 recycling industries (e.g. used oil/cooking oil to produce bio-diesel, plastic/paper/tire/glass recycling).

The goal of the Mongolian National Chamber of Commerce and Industry[6] (MNCCI)is to: i) promote and develop the competitive private sector of Mongolia, ii) cement the MNCCI's position as a capable and influential advocacy organization for the business community and private sector through proposals to the Mongolian government through public-private sector dialogue, iii) aid businesses and investors by providing research on business in Mongolia and promotional services, and iv) be a pro-active member of the international business community by working with the International Chamber of Commerce (ICC), the Confederation of Asia-Pacific Chambers of Commerce and Industry (CACCI) and other international institutions. The National Chamber of Commerce currently has programmes for supporting sustainable consumption and production (SCP). The current programmes include the promotion of green technology as well as supporting green business in industries. The agency is supporting the small businesses with priority on the mining sector.

In Mongolia, according to the Ministry of Health, several laws and orders on the management of healthcare waste have been issued, including:

1 Ministerial order No: 93 (2011): Regarding the calculation and financing of the healthcare waste system;

2 Ministerial order No: 158 (2011/05/03): Regarding the approval of guidelines to classify, collect, store, transport, disinfect, and dispose the waste from healthcare organizations;

3 Ministerial Order No: 179 (2011/05/31): Regarding the approval of waste facility and equipment guidelines of healthcare organizations.
There is no policy for HCWM however different guidelines for implementing healthcare waste are available, including training guides.

6 Mongolian National Chamber of Commerce: http://en.mongolchamber.mn/index.php/home/structure

The national action plan on "Improvement of solid waste management" (2002), the law on "Municipal and Industrial Waste" (2004) and the regulation on "Removal and disposal of hazardous waste" (2002) were approved by the Government of Mongolia and are being implemented. The Regulation for Improvement of Health Care Waste Management and the regulation for Chemical Waste Management (2003) were approved by the joint Order issued by the Ministry of Health and the Ministry of Nature and Environment. Technical support was provided by the WHO for the development of the National Action Plan on Improvement of solid waste management and the regulation for Improvement of Healthcare Waste Management (HCWM). Inconsistencies are found in the management options for medical/infectious wastes in Mongolia. The regulations are interim and suggest a broad range of options for the treatment of medical wastes, including combustion, and do not comprehensively address clear requirements for disposal/combustion facilities nor the need for licensed or special collection services and disposal facilities. National guidelines and plans specific to healthcare waste management have not, as yet, been developed in Mongolia.

Hence, existing regulations should be reviewed and modified as needed. In addition, comprehensive implementation guidelines, standards and detailed practical manuals should be developed. One of the most important issues for adequate implementation of the regulations and standards is the establishment of proper technological and financial mechanisms to address the management of the wastes generated at the different types of healthcare facilities.

The Health Sector Master Plan (HSMP) for developing the sector and improve the health of the people of Mongolia, was approved by Government Resolution # 72 dated 13 April, 2005. Following the development of the HSMP (2006-2015), it became clear that an intermediate step was necessary if the implementers were to be able to use the Health Sector Master Plan strategies and strategic actions in the development of their operational plans. It also became evident that much more focus would be needed to move from the broad strategies listed in the Health Sector Master Plan to their actual implementation. Hence, the development of an Implementation Framework became inevitable.

The National Strategy on the Improvement of Health Care Waste Management and Action Plan for 2009-2013 was developed and approved by an Order of the Minister of Health in 2009. There is a national steering committee on healthcare waste and this committee meets from time to time.

Improvement of healthcare waste management and proper disposal of expired drugs are included in the strategic actions of HSMP and identified as an issue for high priority for resource allocation and international support. The Implementation Framework of HSMP identified Strategic action to improve the management of medical waste and disposal of expired drugs sector wide.

National Environmental Health Program (NEHP) - The NEHP was endorsed by the Government in December 2005. One of the main objectives of this programme is to take measures to decrease environmental contamination, to maintain ecological balance, and to decrease diseases caused by negative environmental factors. It focuses on improving solid and liquid wastes management and establishing a special facility for the disposal of medical waste in Ulaanbaatar.

Ministry of Construction and Urban Planning is responsible for the waste stream of construction and demolition waste. Currently there is a construction boom in Mongolia, particularly in the city of Ulaanbaatar, however there is no existing framework or regulations addressing C&D waste as well initiatives on C&D waste recycling and no available data on C&D waste generation as well as the type of C&D waste. Recently it has also been observed that the demolition waste from old buildings contains asbestos, which is toxic for humans. A Special Inspection Agency is currently drafting rules and regulations in the management of C&D waste from collection, transportation, treatment, recovery and disposal. Ulaanbaatar has a special disposal for C&D waste; however, the reuse of demolition waste has not been approved by the government as there is no available standard.

2.4 Financing mechanisms

This section briefly explains financing mechanisms including penalties, national budget, environmental funds and loans, user charges and private sector participation on waste management.

As a result of amendments made to the "Law on Budget" of 2013, and newly adopted "Law on waste" of 2013, authority and opportunity for financial management were transferred to the local government, consequently 1.275 billion MNT spent in 21 aimags for their waste management issues, e.g. Issuing special permit for private people with own truck in those soums, where there is no adequate techniques and expanding a coverage of households and entities payment for waste service fee. (There is an enormous number of soum households who have not paying their fees for many years) as well as transferring the responsibility of citizens and entities for cleaning outside surroundings of their working and living areas.

Given limited government subsidies, SWM in UB city is solely dependent on waste collection fees. The waste collection tariff for households in Ulaanbaatar was set by the Municipal Council in 2006 at Tg 2,500 (US$1.79) per month for Ger areas and Tg 2,000 (US$1.43) per month for apartment residents. However, the district can adjust the tariff level to some extent to reflect revenue requirements and socio-economic conditions of ger residents. In the City Center ger (Naran), the monthly tariff is Tg 3,000 (US$2.14); in the Fringe ger (Sharhad), Tg 2,500 (US$1.79); and in the Midtierger (Bayankhoshuu), Tg 1,500 (US$1.07).

About 30 percent of households actually pay a waste collection tariff. One reason obviously is the socioeconomic condition of poor households. Another important factor is the lack of awareness of the need for environmental protection and public goods. Residents do not seem to have strong confidence in the government's ability to manage waste. Some long-term residents believe that the garbage problem is created by new migrants and are reluctant to pay the collection fee.

Currently, the government has approved the normative classification list, where tariff structure for industries will be elaborated (please refer to the appendices - industrial sectors waste normative estimation).

2.5 Existing initiatives

The Asia Foundation[7] has currently held activities on the program of Urban Services in the Ger Districts of Ulaanbaatar, which includes improving solid waste management, with duration from May 2012 to August 2015. Partners include the City of Ulaanbaatar and the Ger Area districts. The program is supported by Australian Agency for International Development (AusAID). A new amendment on the existing SWM regulations in Ulaanbaatar was approved in May 2015. Management challenges on SWM include unclear city structure, with weak lines of accountability and limited information.

Project areas on improving solid waste management, based on an initial fact-finding exercise which identified solid waste management as a key area for program development, the UB City and the Asia Foundation partnered a model on SWM Khoroo (neighbourhood) Project, which aims to establish an efficient and effective SWM system at Khoroo level in which Ger area residents, khoroo, district, and city municipality authorities, and SWM companies are actively working together to improve SWM in a comprehensive and sustainable manner. The project used a testing and demonstration intervention logic that combines practice, policy, innovation, and learning at the micro-level. The project combined three interrelated components: 1) system development and performance monitoring, 2) infrastructure/technology solutions, and 3) behavioural change. The project was implemented in the six Khoroos.

7 The Asia Foundation is a non-profit international development organization committed to improving lives across a dynamic and developing Asia. The foundation is working with public and private partners, and receives funding from a diverse group of bilateral and multilateral development agencies, foundations, corporations and individuals.

The residents of the Ger areas of Ulaanbaatar commonly cite solid waste management as one of the public services that they are most dissatisfied. Poor solid waste management in the Ger areas contributes to an increase of illegal open dumpsites in public spaces, that includes both waste from households, as well as industrial and commercial waste. Despite the many challenges still affecting the performance of the city of Ulaanbaatar and its districts on improper waste management practices, particularly in Ger areas, the mayor of UB has been emphasizing on improving waste management in the areas, and significant effort and resources are being invested to address the problem.

Solid waste management (SWM) is made more difficult by a sometimes unclear city institutional structure, with weak lines of accountability and limited information. The solid waste companies are a mix of public and private entities, managed at the district level. The level of coordination and cooperation between the city and district levels for solid waste management is generally good, but there are challenges in communication and coordination as well as general lack of internal oversight. At all levels there are fundamental gaps in information that limit the capacity of government actors to hold waste companies accountable or fully understand the existing coverage gaps on waste management issues. Limited resources on waste management are also an ongoing problem and unscheduled maintenance impacts on solid waste collection. Evidence of illegal open dumping in the Ger areas can be attributed to the improper waste management, particularly on the poor waste designed collection systems. Many residents are new to the urban setting and are used to disposing waste informally, thus contributing to the waste problem in the areas. Behaviours on avoiding waste charges fee, deciding not to invest in waste bins for the respective household, open waste dumping in public spaces and missing collection times or misunderstanding the system negatively affect the functioning of the waste management system.

There are experimentation and ad-hoc adjustments to the waste management system being done at the khoroo[8] and district level as well as by the General Manager's office in UB with ideas including city garbage bag program, the use of kheseg[9] leaders and eco-volunteers to guide collection priorities, and the use of centralized collection points to reduce illegal dumping. While these kinds of special initiatives may overcome selected gaps in the system, some communities cannot overall lead to an efficient and well-functioning system in the absence of the comprehensive policy that encompasses the entire system. This gap in policy and practices creates challenges when actors are trying to make improvements in a sequential or organized manner, and creates a tendency for ad-hoc solutions as opposed to comprehensive reform and planning.

Solid waste collection in the Ger areas is expensive, given the poor road conditions, low density settlement patterns and poorly organized households. This makes the process inefficient and time consuming, and therefore costly. While actual costs are difficult to verify nor obtain, it is clear that the city's current fee structure and collection do not actually generate sufficient revenue to cover the cost of providing service to the Ger areas with satisfactory level of service provision.

The types of waste that cause problems and nuisance in the Ger surroundings, include specifically the illegally open dumping of industrial and construction and demolition waste, and the production of ash from wood burning stoves during winter. These unique types of waste require specific strategies and policies, which remain underdeveloped. Technical challenges in nature include inaccessible roads for proper waste collection and transportation of waste, irregular settlement patterns, the need to address proper treatment of ash, very limited recycling capacity, landfill capacity and location, and type of waste trucks available for use

MEGDT received funding from World Bank in the amount of 190,000 USD to undertake the waste inventory project. MEGDT contracted research consulting company to conduct the inventory activity (source: report submitted by Dr. Itgel, Prof. Khandsuren, and Mr. G. Bayasgalan)

8 Khoroo stands for districts in city administrative unit.

9 Kheseg is the sub unit of Khoroo.

Mongolian National Recycling Association (MNRA): UB City has an estimated 800 ton/day of solid waste with a growth of 30% per annum. There is no segregation at source. Three existing landfill sites have exceeded their capacity. Air pollution and water pollution is growing rapidly. There is growing public concern on the hazardous waste (hospital, chemical process, battery, engine oil) which at the present time is illegally dumped on public land. At the moment, there's no existing Eco-Industrial Park in Mongolia. MNRA is working closely with Ulaanbaatar City to develop Eco-parks (cluster of recycling industries) in the vicinity of the dumpsites. The city has agreed to provide land plots to the association. MNRA requested technical assistance to carry-out a feasibility study of the eco-parks. The development pf the proposed Eco-Industrial park is on initial stage in 2015, where partners collaborated for development of feasibility study.

Currently there are 2 proposed Eco-Industrial parks[10] in Mongolia located in Ulaanbaatar. The proposed Eco-industrial parks at Tsagaan Davaa and Narangyn Enger [shown in Figure 17] were visited during the field survey. Narangyn Enger site land area is 172 hectares [in Figure 18], with a controlled landfill accommodating waste up to 2020. Tsagaan Davaa land area is 92 hectares with an open dumping site and recycling facility in Figure 19. The open dumping site in Tsagaan Davaa has been operating for 3 years to accommodate municipal waste in Ulaanbaatar City with 60 locals working at the site (Field survey visit at MNRA, 2015). The City Mayor's Office, the Mongolian National Waste Recycling Association (MNRA) has mobilized recycling factories to establish an Eco-Park with the aim to address waste management problems in Ulaanbaatar, as well as provide jobs and build recycling facilities equipped with technological innovations. It is planned that the Ulaanbaatar City Authority would provide land as well as heating and electricity.

Figure 13 Two proposed Eco-industrial Park: Narangyn Enger and Tsagaan Davaa

10 Eco-industrial park is an industrial park in which businesses cooperate with each other and with the local community in an attempt to reduce waste and pollution, efficiently share resources (such as information, materials, water, energy, infrastructure, and natural resources), and help achieve sustainable development, with the intention of increasing economic gains and improving environmental quality.

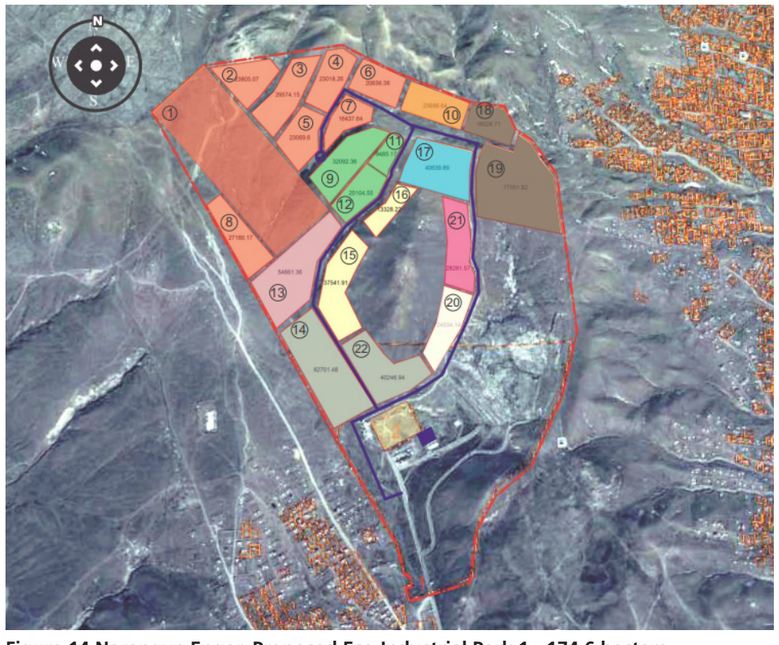

Figure 14 Narangyn Enger, Proposed Eco-Industrial Park 1 - 174.6 hectare

Figure 15 Tsagaan Davaa - Proposed Eco-Industrial Park 2, 92.6 hectare

3. Industrial Waste Inventory

3.1 Approach and methodology in industrial waste inventory

The Conference of the Parties of the Basel Convention have developed a guidance document on the development of inventories of hazardous waste and other wastes ("HoW") under the framework of the Basel Convention[11]. The guidance document includes the methodology, scope, degree of detail and the format of presenting the results of a waste inventory depending on the intended use. This is reflected in table 19 with examples of typical motivations for commissioning hazardous waste and other wastes (HoW) inventories. The order of presentation also represents the typical evolutionary course of different types of inventories. The permanently updated database of annual HoW reports, verified by regular inspections is the ultimate stage that is the most detailed and can be used for multiple purposes, including enforcement actions.

On the other hand, UNEP has also developed a training manual on developing integrated solid waste management plan[12] which includes the industrial waste inventory. The first step is to prepare the list of the industries according to their type, size and technology and to determine major clusters from that list. The next step is the collection of data from records and reports produced by these industries. If the data is available, then this would be a good benchmark and fewer samples would be required only to confirm the applicability of this data. In other cases, a detailed survey needs to be designed. The fourth step is the analysis of the data and to incorporate the changes in industries which may affect solid waste generation patterns.

Table 19 Examples of Types of Inventories [11]

Purpose of an inventory	Characteristics of the inventory	Note
Justifying policy action on a general level	Order of magnitude estimates to verify that the problem exists and should be addressed	Classification of wastes can be on a very general level and estimates based on rough emission factors or only identifying the major waste groups.
Identifying priorities and policy gaps during the life cycle of hazardous materials. Planning of economic instruments e.g. polluter pays principle.	Screening of most significant waste streams and disposal sites. Identify waste groups imposing the most urgent risks. Tentative listing of the biggest HoW generators in each sector. Identify key stakeholders in the relevant sectors.	The inventory can reveal gaps in the legislation, in the classification of wastes as hazardous, management capacity, awareness of waste generators etc. Quantitative accuracy is not so relevant.

11 Methodological guide for the development of inventories of hazardous wastes and other wastes under the Basel Convention, 2013.

12 Developing Integrated Solid Waste Management Plan: Training Manual, UNEP, 2009

Planning of service and investment needs	Order of magnitude estimates of main industrial waste groups. Rough geographical breakdown of generated HoW quantities. Grouping of HoW types by main disposal options (e.g. potentially treatable at landfills, incinerators, recyclable)	Inventories can be conducted in phases starting from regions with big or large numbers of waste generators or starting with wastes applicable for disposal or disposal of a specific type.
Planning of services for specific waste types	Inventories can be based on the consumption of products generating the specific waste type, such as e-waste, batteries, vehicles, PVC products, lubricating oil etc.	Import and export statistics are an important part of such inventories.
Evaluating the effectiveness of waste prevention policies	Inventories focusing on tracking the change in consumption of the hazardous substance and generation of industrial waste streams from the target sector or activity.	Growth of the target sector can easily override the reduction of specific waste generation. Results can be verified by repeated waste audits using the same sample of waste generators.
Identifying risks of non-compliance and potential for waste recycling, prevention or improving cost efficiency.	Waste audits based on selfmonitoring or using external consultants. Inventories based on detailed fieldwork and analysis of samples.	High cost, but usually best reliability.
Compliance monitoring of individual waste generators	Inventories based on regularly updated databases of HoW generators, self-monitoring and periodical verification by inspection	Results can be used for identifying anomalies, tracking trends, planning inspection. Identifying illegal transfers or export of hazardous wastes.

Steps towards an industrial waste inventory[13]

The following are the steps for industrial/hazardous waste inventory

1 Interpretation of definitions for waste and HW

2 Classification of waste streams

3 Defining scope of inventory
- waste streams to be covered
- geographical area to be covered
- specific exclusions from the scope
- level of classification of waste generating facilities (level of ISIC code or corresponding)
- system and the level of classification of HoW and harmonization between the national and Basel codes.

13 Methodological guide for the development of inventories of hazardous wastes and other wastes under the Basel Convention, 2013.

4 Identifying major HW generators

5 Collecting site specific data

6 Verifying site specific data

7 Calculating national summaries

8 Survey disposal and recycling

9 Survey import and export

10 Assessment of results and conclusions

3.2 Industrial waste inventories in Asia

The following are some industrial and hazardous waste inventories activities undertaken from countries in Asia.

Case 1

An inventory was conducted in 2006 in Greater Cairo area, Egypt based on a sample of 23 industrial establishments was extrapolated to cover all establishments in the area. The estimate concluded that 50,000 t/yr of solid hazardous wastes, 550,000 m3/yr of liquid hazardous wastes and 450,000 t/yr of hazardous wastes sludge was generated in the area[14]. The result of the inventory regarding pharmaceutical industry implied that 546,000 tons of hazardous wastes was generated while 99.95% of this was wastewater. This was because the Ministry of Health at that time had decided in a ministerial decree that "all waste from pharmaceutical industry is hazardous wastes" This case study emphasizes the linkage between HoW generation and integrated pollution control.

Case 2

The national inventory in India routinely uses grouping into three groups: "land disposable hazardous wastes", "incinerable hazardous wastes" and "recyclable hazardous wastes". In 2007-2008 49.55% of all hazardous wastes was recyclable according to the inventory, 6.67% was incinerable and 43.78% land disposable[15]. Such a grouping is useful in estimating the regional need of hazardous wastes landfills and incineration capacity. The classification into the landfill disposable class is determined by analysis of the total organic content or volatile substance content. In practice it is not easy to assess if it is feasible to recycle a waste or not without conducting detailed analysis and market studies. Still this approach to classification is useful because it encourages conclusions and action about disposal capacity.

Case 3

The (Basel Convention Regional Centre) BCRC for South-East Asia commissioned a demonstration project in the Philippines for conducting national hazardous wastes inventories. This inventory focused on three major hazardous wastes streams: acids, alkalis and wastewater sludge from the chemicals industry, metal finishing industry (electroplating) and semi-conductor industry. Hazardous wastes factors were compiled from the annual reports of the regulated companies. Both kg/year/employee and kg/year/ton of production indicators were calculated. For electroplating and semiconductor industry the indicator kg/year per 1000 pieces of product was used.

14 Ramadan,A., Afifi,R., 2006

15 Verma N.K., 2009.

The following problems were encountered in this first generation hazardous wastes inventory exercise:

- The number of employees could mean the number of permanent employees or the total number of actually operating employees. The difference between the two choices can significantly affect the accuracy of the hazardous waste estimate factors
- Statistical calculations to determine a systematic correlation between the number of employees and the annual production quantities failed
- Some data on production capacity are expressed in quantity units per day and there is no information on the number of workdays in a week and the number of work week per year.
- Significant difference between production rate and production capacity.
- Some data on production quantity unit and waste stream generation unit may be incorrectly used or incorrectly written, e.g. weight unit is written as kg while actually intended as metric ton. Production is expressed as pieces or units, not tons.
- Variations of manufacturing process. Despite classified under the same group of manufacturing industrial sub-sector, different process technology and operations affect the generation of hazardous waste in terms of either type or quantities.
- There is also a high possibility that some companies do not monitor or record their hazardous waste streams generation.

Case 4

For sectoral industrial and hazardous waste inventories in Bhutan, methodology[16] steps process include the tasks designation; industry selection and survey procedure; base, terminal, and projection years; mapping; sample size and sampling procedure; administering survey; survey instruments; and data analysis, estimation and evaluation.

Specific example for sector on textile industry where methods and approach in conducting waste inventory includes survey on the following 1) production, plant area, and employment of surveyed units in the area; production shift operations; process flow by type of the factory; water consumption and waste water: water source, water consumption and wastewater generation rate; treatment; effluent quality monitoring; waste containers; housekeeping practice in the factories; chemical inventory and estimation of waste generation from the textile sector.

Preliminary steps of the industrial waste inventory in Bhutan stated with the identification of major industries. Before starting the inventory thorough discussions were carried out on the contents of the questionnaire between the consultant and the enumerators immediately after the first stakeholder workshop. The workshop conducted which included participation from a wide range of stakeholders including representatives from major industries and government agencies such as the Ministry of Health, Ministry of Economic Affairs and Ministry of Agriculture helped to further prioritize the sectors and industries needed to be included in the inventory. During the workshop detailed discussions were also conducted on the format and contents of the questionnaires. The workshop decided to distribute three generic questionnaires, one for e-waste, one for health care waste and one for industrial wastes. The sample of 10% -100% of each of the waste generators were selected through stratified random sampling.Acquisition of data, other data reports, studies sources in conducting industrial waste inventory. All primary data collected through the inventory was entered into excel sheets over a period of 20 days. A common database format was provided by the

16 Managing Hazardous Waste in Bhutan: Inventory report prepared by Karma Yangzom for ADB, 2008

international consultant for entering the data.This was adapted to suit the type of data collected from the inventory in Bhutan. To enable easy data analysis entries were made on an industry wise as well as district basis. Since it was not possible to get information on quantities of waste generated for some industries particularly for e-waste generating industries, qualitative as well as quantitative analysis of the data had to be carried out.

Case 5

For Bangladesh, inventory's identification of hazardous wastes[17], their classification (as per Basel convention, US EPA and WHO categories); mapping of the locations and their projected growth by certain year facilitate locating of facilities required for treating and managing hazardous waste in Bangladesh. The projection of wastewater, sludge, solid waste and hazardous waste generation in certain year period were also conducted to serve well in determining the size and capacity of the required treatment facilities.

The methods followed in tracing, compiling, collecting and analyzing the required information and data included close interaction with the consultant, Ministry of Environment officials, making use of secondary information to identify the industries surveyed for primary data; this was followed by organizing a workshop to present the findings for receiving feedbacks from the hazardous waste stakeholders in the country.

3.3 Identification of major generators of waste in Mongolia

This section provides the main waste streams (classification of origin, content and hazardous material) as well as Industries with highest pollution; and identification of key sectors with biggest/most hazardous waste streams as well as the role of the manufacturing sector.

The use of **chemical substances** on a large scale in Mongolia is maintained in five main sectors: agriculture, manufacturing industries, livestock management, disease control, education and scientific research. In addition, Table 20 lists down the different sectors and activities that generate hazardous chemical wastes.

Meanwhile, uses of radioactive substances are limited to the following sectors: medicine, animal husbandry and agriculture industry, geology and mining, science and education. Major sources for such materials are electron accelerator-microtron MT-22; neutron generators, californium-252 source; and radiotherapy as well as the cobalt-60 teletherapy unit.

17 Hazardous Waste Management in Bangladesh: A country inventory, Ministry of Environment and Forests, under ADB project, 2010

Table 20 Releases by type and media for major economic sectors

Economic Sector and Related Activities	Major Pollution Emissions by Chemical Type	Media to which Emissions are Released	Wastes Emitted as
Agriculture, Forestry and Fishing			
Crop and animal production, hunting and related service activities	POPs	Soil	Liquid, Solid
Mining and Extraction			
Coal/Oil/Natural Gas/Minerals/Metals	Mercury, Cyanide	Water, Soil, Air	Solid, Liquid, Gas
Manufacturing/Industry			
Textiles/wearing apparel/leather	Tanning chemicals (e.g. chromium, lead and ammonium)	Soil, Water	Liquid, Solid
Coke, refined petroleum products, chemicals, pharmaceutical products, plastic products	Industrial chemicals POPs	Soil, Water, Air	Liquid, Gas, Solid
Non-metallic mineral products	Industrial chemicals	Soil, Water, Air	Liquid, Gas, Solid
Basic metals and fabricated metal products	Industrial chemicals POPs	Soil	Liquid
Machinery and equipment, motor-vehicles, other transport equipment	Industrial chemicals POPs	Soil	Liquid
Services			
Electricity, gas, steam and air conditioning supply	ODS	Air	Gas, Solid
Water supply, sewerage, waste management	Industrial chemicals	Air, Water	Gas, Solid
Transportation and storage	ODS POPs	Air	Gas

Source: MNE. 2008. National Chemical Management Profile & Acquired information during Field survey visit on 22-26 June 2015 in Mongolia.
Note: ODS = ozone-depleting substances; POPs = persistent organic pollutants

The hazardous waste classification was approved by the Cabinet meeting of the Government of Mongolia, resolution no. 263 dated 29 June 2015 signed by Prime Minister and Minister of MEGDT. Table below illustrates the approved hazardous waste classifications system in Mongolia.

The approved hazardous waste classification list in Mongolia follows European Waste Catalogue and Hazardous Waste List of the Environmental Protection Agency of Ireland. Provisions in Chapter 4 of the approved document stipulate industrial sectors waste normative estimation. The approved hazardous waste classification list is in appendices section.

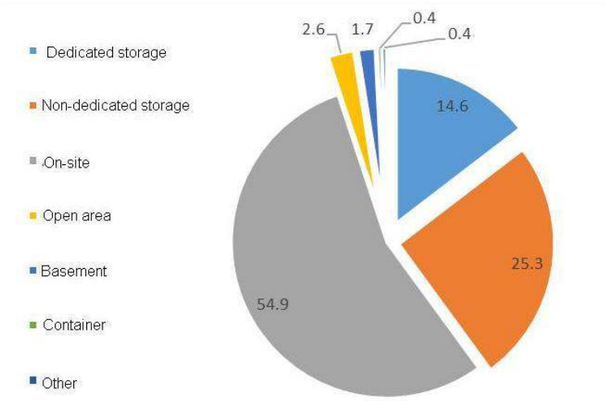

Figure 16 Storage condition of disposal required chemicals substances

Industrial Solid Waste

There is almost no survey material regarding industrial solid waste. However, 2013-2014 environmental status report included the following statistics.

Table 21 Industrial solid waste, tons

Time periods covered	Number of centralized waste treatment points	Area of centralized treatment points, hectare	Industrial solid waste, ton	Percentage in total waste
2010	391	4308.26	117,732.77	14.0
2011	402	11768.37	207,420.10	17.3
2012	426	3831.07	307,486.70	16.0
2013	396	3831.46	166,356.53	6.9
2014	406	-	-	-

In Ulaanbaatar, there are 477 small and medium enterprises operating and it is difficult to find out about their main field of activities and type of waste they produce. Most of the industries are situated in UB.

Construction waste

According to resolution of the Minister of Construction and Urban Development, procedure on construction waste transportation applies.

Sources of waste from construction sites are as follows:

- Construction companies;
- Companies provide building maintenance;
- Enterprises produce building materials;
- Building material whole and retail sellers;
- Individuals and business entities.

According to 2013-2014 environmental status report, Ulaanbaatar produces 217.2 thousand tons construction waste per year.

According to the 2006 JICA survey, waste from construction sites was 60,800 tons during winter while it was 123,000 tons in summer. In 2014, construction companies produced a total of 188,500 thousand tons of waste including 339 tons per day in winter and 688 tons in summer which is a peak period for the construction sector. During this period, the number of construction companies in the city increased 5.6 times[18]. It can be explained that the remaining amount of 28,700 tons of waste originated from other sources. In the long run, the percentage of waste from construction sites will remain high. Therefore, the Citizens Representative Khural of the city decided to demolish old buildings whose utilization period expired.

The Citizens Representative Khural of Ulaanbaatar decided to repair and reuse 210 buildings and to demolish 325 buildings for new construction in 2014, based on the report submitted by professional agencies. These professional agencies carried out technical inspections on 535 apartment buildings whose utilization period expired. It is obvious that such demolishment will produce a lot of waste.

With the support of investment by the Republic of South Korea, it is about to start crushing, sorting and recycling construction waste, to use it for pedestrian road and road construction works and to build plants to produce rock brick and metal work.

In the long run, it is required to support activities related to the collection of waste at designated points, sorting and recycling of the construction waste in all aspects. It is also particularly important to provide tax exemptions to companies reusing the waste to be produced due to demolishment of old buildings and to introduce ecological damage estimation systems[19].

18 Ulziiwww.barilga.mn/r/67998 T. Enkh- Amgalan: The city will have construction waste recycling plant 2014.04.02

19 www.barilga.mn/r70106 L. Olzvoibaatar: Treatment and reuse of waste is the most promising field of construction sector. 2015.05.22

Liquid Waste

Sources of liquid waste are as follows:

- **Treatment plant**
  Liquid waste of Ulaanbaatar is regulated by the Law on Water Supply and Sewerage Utilization of Urban Settlement adopted on October 6, 2011. In the city, there are 17 sewerage treatment plants and the sewerage plants for poultry, meat kombinat, biokombinat, Nisekh, Bayangol-Nairamdal, Sanzai, Nalaikh and Baganuur District use their capacity of 50%, while the central treatment plant has a capacity of receiving about 20,000 m^3 sewerage and treating up to 90-92%. The central treatment plant receives 170,000 m^3 sewerage per day, uses mechanical and biological treatments and treats 65%. In average, 60 thousand m^3 sewerage per day is discharged into Tuul river.

- **Car wash centers**
  In Ulaanbaatar, there are 90 car wash centers and among them, 70 are connected to the centralized system while 20 carry water and discharge their wastewater into open fields. If a single wash center washes 40 cars per day, household uses 15 liter water per car, the car wash center uses 25-40 liter water per small car and 80-100 liter water per big car[20], they produce 2400 liter liquid waste per day. This means that 20 car wash centers produce 48.0 tons of liquid waste per day. If they have 7 months working day in average, they will produce a total of 10.1 thousand tons liquid waste per year.

- **Ger area residents**
  There are 360-380 thousand open pits and sewerage pits in ger areas and camps. A person that resides in the Ger area uses 6-8 liter water and 2555 liter water per year. 40% of the total water is used in cooking and the remaining 60% used in household use. If a single person produces 1.5 tons of sewerage per year, Ger area residents of Ulaanbaatar will produce 3.2 thousand tons of sewerage per day and 1177.5 thousand per year. It can be seen that Ulaanbaatar produces 63.2 thousand tons liquid of waste per day and 23.1 million tons of liquid waste per year.

Gas Waste

Since it is impossible to express gas waste in statistics, only factors causing pollution are being surveyed. Ger area causes 80%, cars -10%, power plants - 6% and soil pollution – 4% of Ulaanbaatar air pollution. Ulaanbaatar is surrounded by four mountains which is the main source of smoked curtain[21].

In order to reduce the air pollution, in 2010-2015, Clean Air project spent a total of 89.84 billion tugrugs for the distribution of smokeless stoves to Ger residents and the reduced use of raw coal.

The Ministry of Environment, Green Development and National Committee jointly completed Ulaanbaatar city's stationary air pollutants inventory work for "Air Quality Smart System" from 2014 to 2015. SICA LLC was selected as an implementer of this study work. During the study of inventory, 6 central districts of Ulaanbaatar city were included in the registration of stationary sources of air pollutants. At the same time, analysis of ordinary and improved stoves' fuel consumption and usage have been completed on both qualitative and quantitative terms. The other part was dedicated to improving stove's report and its utilisation for further air pollution reduction.

20 Research analysis of the consolidated management report of Orkhon river basin water; 2013; page 19

21 www.mongol com.mn/read/25947 Experience shared on reducing air pollution

Hazardous Waste

Issues related to the hazardous waste are described in the annex "Sorting, Collection, Packaging, Temporary Placement, Transportation, Treatment, Storage and Disposal of Hazardous Waste" to the resolution no 135 of the Government of 2002.

In 2008-2014, a total of 1704 business entities have acquired the license for import, use and sale of chemical toxic and hazardous substances. In 2013, 231 business entities have acquired the license for 302,228 tons chemical substances and 325 business entities have acquired the license for 360,500 tons of chemical substances in 2014.

According to the chemical toxic and hazardous substances survey, it is identified that 8,478 types of 250.7 tons of chemical toxic and hazardous substances (in duplicated number) and 494 types of 50,584 liter chemical toxic and hazardous substances (in duplicated number), which do not meet quality requirements and their lifetime is expired, being stored at national level. Furthermore, 70 business entities or companies in 9 districts of Ulaanbaatar stored 2,440 types of 117.9 tons chemical toxic and hazardous substances (in duplicated number) and 398 types of 11,783.8 liter chemical toxic and hazardous substances (in duplicated number).

Only 14.6% of the business entities storing disposable chemical toxic and hazardous substances have a designated warehouse. Out of them, 54.9% store it in their workplace, 25.4% in undesignated warehouses, 2.6% in open area and 1.7% in their building foundation[22].

A total of 832 types of waste are listed in the "Coded list and their grading of waste to be produced due to sources". Among them, 222 types of waste are labeled as hazardous waste and it will be decided whether or not 188 types of waste will be included in the hazardous waste depending on the amount of the foresaid toxic and hazardous substances and hazard rating. Currently, these are not registered and the method and place of disposal as well as amount of the hazardous waste are unclear[23].

Urban residents

In European Union countries, the amount of hazardous waste is 23-442 kilo per person per year while average amount is 40-60 kilo/year. In Mongolia, it is 10-20kilo/year/person while it is 20-30kilo/year in Ulaanbaatar[24].

Table 22 Hazardous waste in Ulaanbaatar, ton

	Measuring unit	2011	2012	2013	2014
Residents	Thousand. people	1201.3	1232.4	1286.3	1314.5
Single person, in average	kilo	25			
Total waste	ton	30032.5	30810	32157.5	32862.5

According to our estimation, Ulaanbaatar residents will produce 30,032-32,861 tons of hazardous waste per year.

22 2013-2014 Environmental Impact Assessment Report; 2015; page -123

23 Ibid

24 Feasibility study of the centralized facility of hazardous waste management in Mongolia, Budapest, Romania; 2009; page

Health care facilities' hazardous waste

Up to 2010, health care facilities themselves were responsible for their special waste. Since 2010, Element LLC became in charge of the foresaid waste. The company receives and disinfects 1.5-3.5 ton[25] waste per day and 600-700 tons of waste from 900 health care facilities per year.

Hides and Skin Processing Plants

16 hides and skins processing plants have a capacity of processing 4000-8000 pcs small cattle skins per day and 4 plants - 200-1000 big and small cattle skins per day, while 12 plants have a capacity of producing 50-70 big cattle skins per week. It is possible to carry out primary and deep processing on 20.0 million pcs skins per year. These are the plants with capacity doubled their resource.

There are 34 hides and skins processing plants. Among them, 32 are located in Ulaanbaatar and 2 in are located in Darkhan – Uul Aimag.

30 out of 32 plants registered in Ulaanbaatar are located in Khan –Uul Disrict and 2 in Bayangol District. Among them, one is state owned, 7 are joint stock and the remaining onesare private plants.

Till the year 2000, hides and skins prepared by herdsmen were exported as raw material. Starting from 2001, the plants leased their buildings to Chinese investor. However, since 2005, the plants started processing the hides and skins as bet- blue by themselves and order. In 2007, the plants started producing processed products and finished products in 2012. Plants to produce final products were founded in 2014. During the hides and skins processing, there is a lot of skin or hide waste produced because of mechanical processing such as packaging, peeling or edging.

Solid and liquid waste which contains chromium, of the hides and skins processing plants negatively affect the environment. Chromium (IV) is very hazardous and most countries refuse to dispose waste which contains chromium in open waste treatment point and dispose and bury in specially designated area. However, there are no special waste treatment facilities for industries in Mongolia.

40-60% of the raw materials of the hides and skins processing plant becomes solid waste and these wastes are valuable raw materials for recycling which contain fat and collagen protein Depending on the hides and skins processing level, types of the waste are various.

Table 23 Waste produced by the hides and skin processing plants in 2012-2014*, ton

	Processing level, thousand hides				Waste produced, tons				
	Deep processed		Semi-processed		Contains no chromium		Contains chromium		Total
	Big cattle	Small cattle	Big cattle	Small cattle	Big cattle	Small cattle	Big cattle	Small cattle	
2011	222.8	1315	172.2	5004	744.8	2226.8	178.2	66.8	3216.6
2012	241.6	263.8	113.2	4992.8	489.6	2221.8	193.3	66.7	2971.3
2013	47.2	457	43.6	3683.2	188.6	1639.0	37.8	49.2	1914.5
2014	50	4500	250	7500	1081.3	3337.5	40.0	100.1	4558.9

*Survey team estimation

The hides and skins processing plants produce 4.5-3.2 thousand tons solid waste per year, in average. Although skin hair and wool are important raw materials, the following types of waste are being produced because of lack of intercommunication and discontinued operations of the processing plants.

25 www.eagle.mn/content read/22507.htm 2014.09.18

Table 24 Cashmere and wool waste, ton

Year	Big cattle, tons	Small cattle, ton	Total, ton
2011	161.95	3159.5	3321.45
2012	145.468	2628.3	2773.768
2013	37.228	2070.1	2107.328
2014	123.0	6000.0	6123.0

Amount of the waste directly related to the operations of the hides and skins processing plants.

Table 25 Total solid waste generation from tannery [hides & skin] industries

Year	Types of waste		Total solid waste
	Solid waste, ton	Cashmere and wool, tons	
2011	3216.6	3321.4	6538.0
2012	2971.3	2773.7	5745.1
2013	1914.5	2107.3	4021.9
2014	4558.9	6123.0	10681.9

The hides and skin processing sectors produce 6.5-10.6 thousand tons solid waste per year.

The European Union countries produce 300-350 kilos leather using 100 kilos processed cattle hides, while Mongolia produces 180-195 kilos leather and disposes the remaining as a waste. Processing of 1 tons cattle hides produces 600-700 kilo solid waste, 40000 liter liquid waste and total 350-450 kilo insoluble solid substances[26].

Hargia treatment facility receives 8000[27] tons water from the hides, skins, cashmere, wool and gut processing plants per day and produces 200 million tons sewerage per year. If the sewerage discharged from all hides and skins plants is treated, total 18 tons mud is produced per day as a result of the treatment of wastewater discharged by all hides and skins processing plants[28].

Sludge

The central treatment plant discharges 138,700 m^3 of sludge with heavy metal per year and the pre-treatment plant discharges 14,600 of sludge with chromium sulfide and other hazardous substances per year (40 tons per day)[29].

26 Business plan of hides and skins sector, 2014; page-160

27 www.time.mn/137-4430/

28 Ts. Oyungerel, Parliament Member

29 First version of the National Program of Waste Improvement, 2013; page -2

3.4 Challenges in the collection of data

Challenges in the acquisition of data and information for Industrial Waste Inventory include the following:

- No available data on industrial waste streams as well as its waste classification;
- Geographical area for the study of industrial waste were limited to identify in what to cover in industrial sector in Mongolia since there is no available data and information at national level;
- At national level no available data on disposal and recycling of industrial waste;
- At national level there is limited data and information on the import and export of waste streams;
- There's no data management system in collection of industrial wastes streams;
- Lack of standards on industrial waste in Mongolia;
- Lack of regulations and processes to measure the waste streams in industries;
- Weak of enforcement of existing laws and regulations on waste in general;
- Lack of cooperation from relevant stakeholders in providing data and information during the conduct of the inventory industrial waste.

3.5 National Waste Flows

Mining/Mineral Extraction Sector

There are about 1,500 active mining companies with special permission, 400 of which are large-scale companies. Mining activities in Mongolia include extraction of gold, copper, coal, limestone, among other minerals. 20% of the GDP in Mongolia is contributed from the mining sector while 90% of the products that are for export, come from the mining industry. For coal enrichment 50 million tons are produced per year where remaining are 20% waste. The 10 types of minerals in Mongolia include: Cu, Coal, Fe, Au, Fluorspar [CaF2], Molybdenum, Ag, Tungsten, Sn and crude oil.

Mining is the largest industry in Mongolia. These mining companies are extracting gold, 44 are mining fluorspar, 28 are extracting coal, and 2 are extracting oil in Mongolia. The mining sector is a major contributor to the Mongolian economy, accounting for 17% of GDP, 65% of industrial output, and 58% of total export earnings. The formal mining sector employs over 12,000 people, and the informal mining sector has an order of magnitude of more workers, however there are no official numbers. Mongolia is a major producer and exporter of copper/molybdenum, gold, coal, and acid- and metallurgical-grade fluorspar.

Top environmental issues related to mining include the uncontrolled chemical waste from leachate and poor rehabilitation of abandoned mining sites. The following factors have been relevant for industrial and hazardous waste management:

- **Gold mining**: washing of metal-bearing sands in dredges and other water washing devices. Use of mercury for amalgamation and extraction of gold also presents a massive environmental hazard.

- **Copper/molybdenum mining**: high energy consumption and tailings storage, which result in dust and contaminated water. The operations involve large quantities of acid, which is spread on old unlined overburden. Monitoring of chemicals' use, facilities, and groundwater is essential.

- **Coal mining**: air quality, reclamation and mine closures (e.g., metal leaching after mine closure), dust from operations and rock overburden piles, and concentrations of carbon monoxide within the mines are the main problems.

Gold Mining Company: Ten Khun Corporation (Chinese Owned Company): The factory is using Cyanide in the extraction of Gold. The company has a waste treatment system particularly for the CN waste water. Since the mining area is a special zone for vegetation and agriculture, the company is treating wastewater containing CN to reduce 5-10 ppm which is below the state standard of 25 ppm. The company started its operation in 2011, with an area capacity to mine of about 265,000 cubic meters. Chemical substances that are used in the in the mining plant include CN, HNO_3, $Ca(OH)_2$, NaCl, Na_2CO_3, $H_20_4C_2$, CaO. One of the pressing issues of the mining plant is where to dispose CN packaging material, since there is no available special landfill to contain the CN packaging waste material.

Healthcare/Medical Sector

From a 2004-2005 baseline study by WHO, a total of about 2.65 tonnes of healthcare waste were produced each day in Ulaanbaatar (about 0.78 tonnes of medical wastes and 1.87 tonnes of general wastes). The contribution of medical waste to the total waste stream produced in a particular type of facility varies from about 13.56% to approximately 98%. In general, the major concentration of materials in the medical waste stream consisted of syringes and gloves. Most of the health-care facilities in Mongolia are located in UB, given the fact that almost half of the population in the country reside in the capital city.

The waste generation rate in the healthcare facilities of Ulaanbaatar is lower than in some other countries; however, the percentage of medical wastes in the total waste stream is comparatively high, ranging from 12.5% to 69.3%, which indicates poor waste handling practices.

Although generally minimal, healthcare facilities are also a source of radiation and radioactive substances, specifically in radiotherapy and medical diagnostics (e.g. cobalt-60).

Manufacturing Sector

Waste generation is also considered a key environmental issue in the following activities under the manufacturing sector in Mongolia:

- Heavy industry
  - Glass production
  - Metal production
  - Polystyrene plant
  - Wastewater treatment plant (sludge generation)

- Light industry
  - Cotton mill
  - Textile factory
  - Furniture plant
  - Pharmaceutical industry (toxic waste generation)
  - Printing house
  - Tannery
  - Wool, cashmere processing

- Food industry
  - Beverage factory
  - Meat product production (hazardous waste generation)
  - Milk product production

To cite for tanneries, currently, there are 34 tanneries in Mongolia, 32 of which are located in Ulaanbaatar and 2 located in the outskirts of Ulaanbaatar, in addition to this there are 90 factories for leather and apparels production. After privatization of the tanneries, recycling operation was lost, leading to most of the waste streams from the tanneries being dumped somewhere in Ulaanbaatar. The Association requested assistance to upgrade the tanneries, as most of the factories' equipment and facilities are outdated and only traditional technology is used. The Tannery Research Institute is submitting a proposal to reduce the waste in the tannery sector (Field surveyed at Tannery, Leather and Apparel Association, July 2015). The tannery park land area consists of 30 hectares. The factory that was visited, disposes their waste containing lead and chromium, in canals without treatment. Poor occupational health was observed within the factory, and it was found that ammonium is released during the operation, where workers do not have safety gear e.g. mask and gloves, as well poor ventilation in the facility. No proper housekeeping within the factory was noticed. The 26 other tanneries are in similar situation, while 6 of the other tanneries have advanced technology to treat their waste.

There is no available data and information as well as background information for heavy industries.

3.5.1 Waste Segregation and Storage

In large-scale mining sites, waste is also sorted into different categories, such as recyclable wastes, inactive wastes, hazardous wastes, and non-hazardous wastes. The level of rigor in waste sorting depends on the mining operators. For instance, waste generated in mine sites of Oyu Tolgoi—Mongolia's largest copper and gold mining company—are sorted into 33 types under the said categories. Companies that recycle and neutralize some types of wastes, in particular hazardous wastes, are not sufficient in rural areas as well as throughout Mongolia. Therefore, some wastes are stored at waste disposal points until an acceptable recycling/neutralization option becomes available. At present, waste that cannot be recycled/neutralized is being stored at the waste management facility. On the other hand, small-scale and artisanal mining sites lack proper waste handling measures and facilities found in large-scale mining sites. In this regard, the former are areas of concern for uncontrolled burning of rubber tires (a recyclable waste); seepage and dumping of mine tailings and acid mine drainage; and illegal use of mercury.

In the healthcare facilities (HCFs), hospital wastes/medical wastes are segregated according to their characteristics, mainly into the following categories: sharps, infectious wastes, pathological wastes and pharmaceutical wastes. Although a system of colour coding or labelling of waste containers/bags has been adopted, not all facilities strictly follow the national regulations to practice the colour coding system. The medical wastes are segregated into: infectious wastes, sharps, pharmaceutical wastes and chemical wastes. However, in some HCFs the wastes are collected and stored in plastic bags, paper bags or cardboard boxes, which show inadequate waste handling practice regarding the regulations on "Removal and disposal of hazardous waste" (2002), and "Improvement of healthcare waste management" (2003). All medicines are stored at each HCF, and at the end of the year an inventory of all medicines is conducted and those that have expired are disposed. Radioactive waste generated at the Cancer Research Center is collected by personnel from the Atomic Energy Commission for proper storage and treatment.

3.5.2 Waste Collection and Transportation

75% of total waste is collected by city waste maintenance organizations and 15% is transported by the organizations with their own trucks, while 5-10% of waste is left without being transported. There are currently 173 registered trucks for solid waste transportation in Ulaanbaatar city, however over 30% is old trucks with outdated use (Altantuya, Zhang and Li, 2012).

The first stage of segregation of recyclables starts from doorkeeper, boots and maintenance personnel of hotels, restaurants and commercial centers, who segregate recyclables and delivers to the recyclable collection sites. In addition, recyclables have also taken by a network of informal recyclable's collection and service.

A number of the industries have their respective collection and transportation of industrial waste and treatment of waste inside the plant. However, most of the industrial waste is being disposed in disposal site but also oftentimes discharged in water streams.

Most HCFs have a contract with the District Upgrading Service for waste collection, and general waste is usually transported to the city disposal site. There is no special service for transporting medical waste from the city; therefore, some HCFs use their own vehicles to transport the waste.

3.5.3 Recovery and recycling

Currently 52,600 tons recycled solid wastes annually have been recycled in 8 provincial centers. Resource recovery of other industrial wastes is also in place in larger mining sites. For example, in Oyu Tolgoi, 983 truckloads of waste timber, 60 truckloads of sandwich panels and used tires were given to local communities for various purposes and 2971 bags (1 ton) of plastic cans, and 1318 tons of scrap metal, a total of 1773 tons of waste oil were supplied to a recycling factory. However, mining companies do not re-process used oil and spare parts, thus generating large volumes of wastes. Some recycled materials are processed in Mongolia such glass, used tires and paper, among others. However, most of the recycled materials are transported to China for further recycling process. There is no existing Eco-Industrial park in Mongolia.

3.5.4 Waste Treatment and Disposal

There are total of 417 large and small centralized disposal sites in the country, including 5 sites in Ulaanbaatar city, 1-2 in each of the 21 provinces and 329 soums and settlement centers. Almost 30 per cent of the waste generated (total of 1.4 million tons per year) is originated in Ulaanbaatar, consisting of 350,000 tons of household garbage, 50,000 tons of construction garbage, **10,000 tons of hazardous and chemical waste and 1,000 tons of medical litter**. At the present time activities to furnish centralized disposal site and introduce landfill method have been conducted neither in Ulaanbaatar city nor the 21 Aimags. A partnership with the Hungarian firm "Kornezet" is expected to develop facilities for hazardous waste disposal, however more participation from the private sector would be beneficial.

A small and medium enterprises development national fund is established to promote business sectors including waste management system. Small enterprise is established with direct investment and collaboration of Battery Equalizer International (BEI) to reuse batteries used in Mongolia. The private sector is also engaged into processing of used tires. First productions are rubber mat and sport centers floor mat.

Incinerators to destroy medical wastes, and autoclave to disinfect and sterilize, have been established at the centralized disposal site of Ulaanbaatar city and activities have been conducted to transport by the specially equipped trucks, destroy and sterilize wastes of about 200 private and state-owned hospitals.

The data derived from the City Health Department (2005) show that 11.5% of HCFs had on-site, low-temperature, small-scale incinerators, 79.4% had contracts with these facilities to burn the medical waste, and 9.1% discharged (burnt or simply buried) the wastes at the disposal site. This indicates that HCFs in Ulaanbaatar city practice unsafe combustion. In addition, monitoring of the emissions from the incinerators is not carried out due to a lack of analytical capacity. A few facilities used autoclaves to treat infectious wastes.

As mentioned, handling and treatment of hazardous wastes from large-scale mining sites are contracted out to private companies. Due to a lack in these kinds of waste recycling/treatment companies, some hazardous waste is disposed of in landfill areas and fed to high-temperature incinerators installed in the mining sites. Smaller scale and artisanal mining sites still practice improper waste disposal, especially into nearby rivers.

3.6 International Waste Flows

This section discusses the collection of data on transboundary movements of hazardous wastes and others wastes, import/export of waste, and possible regional/international markets and buyers of wastes.

There is an increasing need for better hazardous waste management in Mongolia, given that the country imports a significant amount of second-hand goods from China, South Korea, Singapore and the United States. Hazardous chemical waste and e-waste are often generated due to the short life-span of these products. Waste is also generated due to the lack of a repair industry and the lack of spare parts for products with partial defects.

Chemicals are important raw materials because chemical substances are involved in every production not only for agricultural and industrial but also for consumers sectors. Mongolia imports most primary chemicals for producing products that relate to upstream and downstream industries, which increases the value added to products. With regard to chemicals management, involving waste issues, there are many agencies involved. All of them have their own information and data collecting strategies. Their recording systems are not harmonized; therefore, there are some overlaps and gaps in chemicals management information. In order for better chemical waste management scheme, greater attentions should be placed on the search and analysis of available waste information.

In terms of chemicals, until 1990 Mongolia imported all chemicals from former Soviet Union and since 1990s with the transition to the market economy the importation of chemicals from countries such as the Russian Federation, Germany, China and the Republic of Korea becoming to prevail. Mongolia produces bio-fertilizers in small amount, however, does not produce mineral fertilizers.

Major part of total required chemicals for agriculture and industry is imported and only a slight portion is produced in the country (Table 26). For example:

- Petroleum products
- Consumer chemicals (soap, washing powder, shampoo and cosmetics)
- Pharmaceutical products

Table 26 Raw materials for chemicals and related industries

Raw Materials	Import (tonnes or volume/year)	Export (tonnes or volume/year)
Petroleum	7832.0	
Crude oil		129.4 barrel
Tanning chemicals, skin bleaching and brightener	20090	
Chemicals in mining	120542	
Other raw materials for brewery and food products, coloring chemicals	60271	

Table 27 Chemical waste generation and trade

Type of Chemical Waste	Generation (tonnes/year)	Export (tonnes/year)	Import (tonnes/year)
Domestic	186.5 thousand	-	-
Industrial	15.2 thousand	-	-

There is limited data and information on hazardous waste, which are not available at the moment at the time of the conduct of this study.

4. Inventory of Results

4.1 Policy recommendations on a national level

Based on the above situation on industrial waste inventory from media on liquid, gaseous and solid, the following gaps emerge.

Liquid media

While the regulatory and institutional framework involves different stakeholders, there still lacks an integration of the water sector within the waste sector in Mongolia, the former being mainly focused on providing (potable and safe) water supply; and the latter, on solid waste management. Compared to solid waste, wastewater is still generally addressed as an end-of-pipe problem, with management solutions focusing on sewerage and treatment. While there are regulations on discharge limits to industries, there is still much to do regarding regulatory and institutional mechanisms related to 3R or integrated water resource management in water sector, in which wastewater is embedded.

As mentioned, there are also issues in vertical integration and consequently decentralization of wastewater management, given the lack of coordination among different actors, and given the minor focus on wastewater within the overall framework of the water sector. There is also a gap between urban and non-urban areas, which is critical, given that the latter areas have potentially more hazardous wastewater due to the presence of industries (e.g. mining); compared to urban areas where the wastewater is mostly domestic in source.

Despite the end-of-pipe approach to wastewater management, Mongolia has a weak infrastructure base for wastewater treatment, especially in peri-urban and rural areas. There is also a lack of technologies and methods for wastewater reuse and recycling in both households and industries, which could help in alleviating the pressure on the capacity of sewer/drainage systems and wastewater treatment plants.

There is also a gap between service provision for wastewater and cost recovery for such service. The costs incurred for wastewater is currently not reflected in the water tariff. In addition, water supply service also has low cost recovery, which implies that the subsidy for wastewater treatment is currently insufficient.

Finally, stakeholder participation is currently limited, given the end-of-pipe approach to wastewater management. Current focus is on engaging the private sector in service provision and investment in treatment facilities, while participation and awareness-raising of wastewater generators (households and industries) is still lacking.

Gaseous media

Based on the above situation of gaseous emissions management in Mongolia, the following gaps emerge.

The diffuse and cross-cutting nature of gaseous emissions necessitates a more holistic management approach, which is seen in the existing institutional and legal framework. Gaseous emissions in Mongolia are being mitigated and managed under the context of air quality and climate change. As such, various sectors are involved at the higher governance levels. However, with this existing framework, strong decentralization mechanisms are lacking (e.g. roles of municipal government and its departments), which has implications for mitigating emissions at local and household levels.

Currently, this task is mainly done by the Ministry of Environment, Green Development and Tourism. As with wastewater management, there is also a gap between urban and non-urban areas, as air quality management is focused on Ulaanbaatar City.

In addition, there is also a noted gap in horizontal (sectoral) integration, especially with the waste sector. As mentioned, the current focus of gaseous emissions management is on the energy sector, with minor priority for the waste sector, which, among others, is crucial for methane emissions. Integration specific with the mining/mineral extraction sector, a major sector in Mongolia (also for its solid, liquid and gaseous waste generation), is also lacking.

There is also a noted technology gap in terms of gaseous emissions mitigation in Mongolia, such as in cleaner energy sources and more environmentally sound technology. The principle of 3R available in waste sector is also not taken advantage of in technology development, such as resource recovery and reuse of gaseous by-products (e.g., heat, methane).

Compared with solid waste and wastewater, the management of gaseous emissions is very difficult, if not impossible, to fund at local levels because it is not a public service. Consequently, the said sector is dependent on government, corporate, and donor funding, which is not sustainable in the long term.

While private sector is more easily tapped by virtue of economic measures (e.g. incentives), public participation in mitigating emissions is more challenging. This can be related to the current situation wherein public information is handled more by government agencies than by local government.

Solid Waste

The key gap in the legal and institutional framework for SWM is on integration, specifically the coordination between the strategic and operational levels of SWM (vertical), and the coordination between SWM and other relevant sectors such as environmental management and urban management (horizontal). As seen in the aforementioned situation, the legal instruments for SWM are not embodied or enforced by the existing institutional framework for SWM in Ulaanbaatar City. While service provision (collection and transport) is delegated to the district level, the responsibility of enforcing relevant laws and regulations remains at the higher level, i.e., from Municipal Governor's Office and up. Meanwhile, SWM is ideally embedded within the greater contexts of environmental management and urban management, as seen in the relevant laws and regulations at the national level. However, in practice, these sectors are not coordinated, missing the opportunities of sharing resources and expertise towards improving SWM system in Ulaanbaatar City. A silo approach to SWM should be expanded to harness the contributions of other relevant sectors.

Opportunities at the national and international levels, for one, the transition of Mongolia to a market economy is a positive point in the sense that it could lead to better engagement of the private sector in SWM, both local and foreign. This engagement can be in the form of investments and service provision. The existing international agreements (e.g., Basel Convention, Rotterdam Convention and Stockholm Convention, which all deal with hazardous wastes and pollutants) entered into by Mongolia also provide opportunities for industrial waste management. Particularly in UB city, especially by adopting policies, regulations and standards contained within these treaties at the lower governance levels. As of 2009, regulations on hazardous wastes are already adopted at the national level. International cooperation is also a great opportunity for UB, since these collaborations (e.g. with JICA, World Bank, WHO, Japanese government, Netherlands government, Australian government) provide the much needed technical and financial assistance for the betterment of SWM in UB city.

In response to the gaps presented in the preceding section, the following are the most promising recommendations for Industrial Waste Inventory in Mongolia:

Data and information

- There is limited data and information on Industrial Waste in Mongolia. There is a need for data collection on Industrial Waste as well as a need of appropriate methodology in the acquisition of data and information of industrial waste in every Aimags is to be developed.

- There is a need to propagate the acquisition of industrial waste inventory in Mongolia - to draw an accurate baseline data on the quantification of industrial waste.

Awareness raising and capacity building

- Raise awareness on green economy for different sector of industries, advocating green economy in industries to achieve sustainable development.

- Promote educational activities to increase environmental and health awareness of the population in Mongolia

Policy, regulations and standards

- Most of the industrial processing and manufacturing companies are using industrial chemicals and other hazardous chemical substances in Mongolia which are generating potentially harmful industrial wastes. There is a need of a policy on occupational health for workers in respective industries.

- Currently there are no standards on industrial waste in Mongolia, no provisions on the permissible or allowable waste discharges. A need to develop industrial waste standards at national should be explored.

- Better legal and enforcement framework for ensuring safe environment and sustainable development.

Infrastructure and Technology

- Most of the industries do not have existing treatment facilities on their respective waste discharge e.g. tannery sector.

- Adopt green measures in the industrial sector may be viewed as an investment f.or the country

- Potential to develop a project on eco-industrial park is recommended where industrial recycling activities

- An Eco-industrial Park serves to stimulate the creation of green jobs and recycling companies that can positively contribute to the economy.

    · Reduce emissions, industrial waste management practices such as the by-product of waste of a certain factory could be used as a resource to other recycling facilities.
    · Important policy actions need to be considered, like the establishment of economic incentives to encourage recycling and recovery techniques and methodologies that will be applied in the Eco-Park.

- With an eco-industrial park there will be material exchange or waste reuse linkages as well as interaction of social, economic, environmental, and political factors.
- Foreseen that technologies in the eco-industrial park need to accommodate/ convert to the recycling of these waste streams including municipal waste, agricultural waste, sewage, and plastic.

Stakeholders Participation

- More involvement and participation of the private sector in the waste management system, particularly in establishing recycling industries.

- Develop policies/strategies at national and city level that will stimulate the creation of green jobs and facilitate the greening of the industry sector in addressing waste management

4.2 Hindrances and obstacles

Issues and potential tensions/uncertainties of industrial waste management, distribution of impacts within and among the stakeholder groups in Mongolia may include the following:

- There may not be any political will of the city administration and or at the central government to promote green economy through the establishment of an Eco-Industrial Park encouraging green jobs and recycling activities - for the well-being of the community.

- Potential obstacle on social or public unacceptance of the installation of Eco-industrial Park, especially the community surrounding the facility.

- Continuing the advocating of green industries for effective and efficient industrial waste management with the changing of administration.

- Potential obstacle in the access of infrastructure and services such as water where the Eco-park will be installed.

5. Conclusions

The total population of Mongolia in 2014 was 2,995,900, and has increased by 65,600 or 2.2 % compared with year 2013. In 2014, the total foreign trade turnover reached USD 11.0 billion, consisting of USD 5.8 billion for exports and USD 5.2 billion for imports. In parallel to the population and economy increase, Mongolia generated 2,394,648 tons of solid waste in 2013 and the number is increasing yearly. In terms of chemical waste generation, 186,500 tons/year are domestic chemical waste and 15,200 tons/year are industrial chemical waste. With these amounts generated, a proactive solution is needed to reduce the waste generated as well as reducing the impact on environment and health problems in the country. The promotion of green economy has just kicked off and the awareness raising of these principles, particularly to the industries, is needed.

The study also encountered difficulty in acquiring data and information, since there is limited information on industrial waste generation in industrial waste as well as solid waste in general.

Most of the investors in Mongolia are multi-million foreign investors having companies like in mining and manufacturing sector where there may be potential for establishment of international waste standards.

Currently there is no industrial waste treatment/recycling Facility Park in Mongolia industries normally have their own treatment facilities and most of the industries also dispose their waste in water bodies and dump them in landfill. Generated waste is transported and treated in another facility. Potential steps to realize the development of treatment/recycling facility is to develop methodology and standards in industrial waste emissions as well as the acquisition of data and information of industrial waste.

Recycling initiatives are almost non-existent due to the lack of recycling facilities within the country, excluding some small private businesses. Awareness raising and capacity building in greening industries at local level with the active participation of industries is highly recommended.

Recently, the hazardous waste classification was approved by the Cabinet meeting of the Government of Mongolia, resolution no. 263 dated 29 June 2015 signed by Prime Minister and Minister of MEGDT. Since there is now an existing and approved classification list, there will be potential to develop an Eco-Industrial Park.

MEGDT received funding from World Bank in the amount of 190,000 USD to undertake the waste inventory project.

Though Mongolia has natural resources and land space for waste, there's potential source of economic value in embracing green economy in their policies. Conventional end-of-pipe measures are perceived as a cost by business and the industries, industrial ecology approaches are recommended, thereby reducing costs and increasing competitiveness.

There is a potential for the development of eco-industrial projects in Mongolia, particularly that Ulaanbaatar City is keen in establishing an Eco-industrial park, as the city is able to provide land for the facility.

Establishing an Industrial Eco-Park need political will from the central government, which could provide both technical and financial support to local governments to establish an area where reduction of waste is promoted through various recycling and industrial symbiosis efforts to promote and encourage ecologically sound industrial activity, as well as material exchange or waste reuse linkages. With an eco-industrial park in Mongolia there will be a prompt to reduce dependence on virgin resources and to lower waste disposal requirements and production costs.

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Appendices

1. Mongolian Hazardous Waste Classifications System[30]

Waste Source Chapter	Waste Source sub-chapter, chapter code	Waste Code	Hazardous Waste Name	Hazardous Level
01. Waste resulting from exploration, mining and treatment of minerals	01 02. Physical and chemical processing of metalliferous minerals	01 02 01	acid-generating tailings from processing of sulphide ore	A
		01 02 02	other tailings containing hazardous substances	X
		01 02 04	other wastes containing hazardous substances from physical and chemical processing of metalliferous minerals	X
	01 03. Physical and chemical processing of non-metalliferous minerals	01 03 01	wastes containing hazardous substances from physical and chemical processing of non-metalliferous minerals	X
	01 04. Drilling muds and other drilling wastes	01 04 02	oil-containing drilling muds and wastes	X
		01 04 03	drilling muds and other drilling wastes containing hazardous substances	X
02. Waste from agriculture, horticultural, aquaculture, forestry, fisheries, hunting and food preparation and processing	02 01. Waste from agriculture, horticultural, aquaculture, forestry, fisheries, hunting	02 01 07	agrochemical waste containing hazardous substances	X
		02 01 09	Pesticide waste	A
03. Waste from wood processing and production of paper, cardboard, pulp, panels and furniture	03 01. Waste from wood processing and the production of panels and furniture	03 01 02	sawdust, shavings, cuttings, wood, particle board and veneer containing hazardous substances	X
	03 02. Waste from wood preservation	03 02 01	non-halogenated organic wood preservatives	A
		03 02 02	organochlorinated wood preservatives	A
		03 02 03	organometallic wood preservatives	A
		03 02 04	inorganic wood preservatives	A
		03 02 05	other wood preservatives containing hazardous substances	X

30 Hazardous waste classifications system in Mongolia, Resolution no. 263 dated 29 June 2015 signed by Prime Minister and Minister of MEGDT.

04. Waste from the leather, fur, wool, cashmere processing, and carpet, textile yarn, spinnery	04 01. Waste from leather and fur industry	04 01 03	degreasing wastes containing solvents without a liquid phase	A
		04 01 04	tanning liquor containing chromium	X
		04 01 09	wastes from dressing and finishing	X
	04 02. Waste from wool, cashmere industry	04 02 03	waste containing hazardous chemical solvents	X
		04 02 05	waste containing expired or unused chemicals	X
		04 02 06	sludges, in particular from on-site effluent treatment containing hazardous substances	X
	04 03. Waste from carpet, textile yarn, spennery industry	04 03 02	wastes from finishing containing organic solvents	X
		04 03 04	dyestuffs and pigments containing hazardous substances	X
		04 03 06	sludges from on-site effluent treatment containing hazardous substances	X
05. Waste from petroleum production, gas exploration, mining, production and shale	05 01. Waste from petroleum production	05 01 01	desalter sludges	A
		05 01 02	tank bottom sludges	A
		05 01 03	acid alkyl sludges	A
		05 01 04	oil spills	A
		05 01 05	oily sludges from maintenance operations of the plant or equipment	A
		05 01 06	acid tars	A
		05 01 07	other tars	A
		05 01 08	sludges from on-site effluent treatment containing hazardous substances	X
		05 01 10	wastes from cleaning of fuels with bases	A
		05 01 11	oil containing acids	A
		05 01 14	spent filter clays	A
		05 01 15	soil polluted by oil spills	X
		05 01 16	drilling mud	X
		05 01 17	oil contaminated metal scale, polishing residual	X
		05 01 18	oil polluted wrap, clothes, filters	X
	05 02. Waste from pyrolytic treatment of coal	05 02 01	acid tars	A
		05 02 02	other tars	A
		05 02 03	wastes containing mercury	X
	05 03. Waste from gas exploration, mining, production	05 03 01	wastes containing mercury	X

06. Waste from inorganic chemical processing, supply, and use	06 01. Waste from manufacture, formulation, supply and use of acid	06 01 01	sulphuric acid and sulphurous acid	A
		06 01 02	hydrochloric acid	A
		06 01 03	hydrofluoric acid	A
		06 01 04	phosphoric and phosphorous acid	A
		06 01 05	nitric acid and nitrous acid	A
		06 01 06	other acids	A
	06 02. Waste from manufacture, formulation, supply and use of bases	06 02 01	calcium hydroxide	A
		06 02 02	ammonium hydroxide	A
		06 02 03	sodium and potassium hydroxide	A
		06 02 04	other bases	A
	06 03. Waste from manufacture, formulation, supply and use of salts and their solutions and metallic oxides	06 03 01	solid salts and solutions containing cyanides	X
		06 03 02	solid salts and solutions containing heavy metals	X
		06 03 04	metallic oxides containing heavy metals	X
	06 04. Metal containing waste	06 04 01	wastes containing arsenic	X
		06 04 02	wastes containing mercury	X
		06 04 03	wastes containing other heavy metals	X
	06 05. Sludges from on-site effluent treatment	06 05 01	sludges from on-site effluent treatment containing hazardous substances	A
	06 06. Waste from manufacture, formulation, supply and use of sulphur chemical and sulphur chemical processes and desulphurisation processes	06 06 01	wastes containing hazardous sulphides	X
	06 07. Waste from manufacture, formulation, supply and use of halogen chemical processes	06 07 01	wastes containing asbestos from electrolysis	A
		06 07 02	activated carbon from chlorine production	A
		06 07 03	barium sulphate sludge containing mercury	A
	06 08. Waste from manufacture, formulation, supply and use of silicon and silicon derivatives	06 08 01	wastes containing hazardous chlorosilanes	X
	06 09. Waste from manufacture, formulation, supply and use of phosphorous chemical and phosphorous chemical processes	06 09 02	calcium-based reaction wastes containing or contaminated with hazardous substances	X
	06 10. Waste from manufacture, formulation, supply and use of nitrogen chemical and nitrogen chemical processes	06 10 01	wastes containing hazardous substances	X
	06 12. Waste from other inorganic chemical processes	06 12 01	inorganic plant protection products, wood-preserving agents and other biocides.	A
		06 12 02	spent activated carbon (except 06 07 03)	A
		06 12 04	wastes from asbestos processing	A
		06 12 05	soot	A

07. Waste from organic chemical processing	07 01. Waste from manufacture, formulation, supply and use of basic organic chemicals	07 01 01	aqueous washing liquids and mother liquors	A
		07 01 02	sludges from on-site effluent treatment containing hazardous substances	A
		07 01 03	organic halogenated solvents, washing liquids and mother liquors	A
		07 01 04	other organic solvents, washing liquids and mother liquors	A
		07 01 05	halogenated still bottoms and reaction residues	A
		07 01 06	halogenated filter cakes and spent absorbents	A
		07 01 07	other still bottoms and reaction residues	A
		07 01 08	other filter cakes and spent absorbents	A
		07 01 09	sludges from on-site effluent treatment other than those mentioned in 07 01 08	X
	07 02. Waste from manufacture, formulation, supply and use of plastics-synthetic rubber, and man- made fibres	07 02 01	aqueous washing liquids and mother liquors	A
		07 02 02	other organic solvents, washing liquids and mother liquors	A
		07 02 03	halogenated still bottoms and reaction residues	A
		07 02 04	other still bottoms and reaction residues	A
		07 02 05	halogenated filter cakes and spent absorbents	A
		07 02 06	other filter cakes and spent absorbents	A
		07 02 07	sludges from on-site effluent treatment containing hazardous substances	A
		07 02 09	wastes from additives containing hazardous substances	A
		07 02 11	wastes containing silicones	X
	07 03. Waste from manufacture, formulation, supply and use of organic dyes and pigments	07 03 01	aqueous washing liquids and mother liquors	A
		07 03 02	organic halogenated solvents, washing liquids and mother liquors	A
		07 03 03	other organic solvents, washing liquids and mother liquors	A
		07 03 04	halogenated still bottoms and reaction residues	A
		07 03 05	other still bottoms and reaction residues	A
		07 03 06	halogenated filter cakes and spent absorbents	A
		07 03 07	other filter cakes and spent absorbents	A
		07 03 08	other still bottoms and reaction residues	X

	07 04. Waste from manufacture, formulation, supply and use of organic plant protection products	07 04 01	aqueous washing liquids and mother liquors	A
		07 04 02	organic halogenated solvents, washing liquids and mother liquors	X
		07 04 03	halogenated still bottoms and reaction residues	A
		07 04 04	sludges from on-site effluent treatment containing hazardous substances	X
		07 04 06	solid wastes containing hazardous substances	X
	07 05. Waste from manufacture, formulation, supply and use of pharmaceuticals	07 05 01	aqueous washing liquids and mother liquors	A
		07 05 02	halogenated still bottoms and reaction residues	A
		07 05 03	halogenated filter cakes and spent absorbents	A
		07 05 04	sludges from on-site effluent treatment containing hazardous substances	X
		07 05 06	solid wastes containing hazardous substances	X
	07 06. Waste from manufacture, formulation, supply and use of fats-grease-soap-detergents-disinfections and cosmetics	07 06 01	aqueous washing liquids and mother liquors	A
		07 06 02	organic halogenated solvents, washing liquids and mother liquors	A
		07 06 03	other organic solvents, washing liquids and mother liquors	A
		07 06 04	halogenated still bottoms and reaction residues	A
		07 06 05	other still bottoms and reaction residues	A
		07 06 06	halogenated filter cakes and spent absorbents	A
		07 06 07	other filter cakes and spent absorbents	A
		07 06 08	sludges from on-site effluent treatment containing hazardous substances	X
	07 07. Waste from manufacture, formulation, supply and use of fine chemicals and chemical products	07 07 01	aqueous washing liquids and mother liquors	A
		07 07 02	organic halogenated solvents, washing liquids and mother liquors	A
		07 07 03	other organic solvents, washing liquids and mother liquors	A
		07 07 04	halogenated still bottoms and reaction residues	A
		07 07 05	halogenated filter cakes and spent absorbents	A
		07 07 06	sludges from on-site effluent treatment containing hazardous substances	X

08. Waste from MFSU of coating, adhesives, inks	08 01. Waste from manufacture, formulation, supply and use and removal of paints and varnish	08 01 01	sludges from paint or varnish containing organic solvents or other hazardous substances	X
		08 01 03	waste paint and varnish containing organic solvents or other hazardous substances	X
		08 01 05	wastes from paint or varnish removal containing organic solvents or other hazardous substances	X
		08 01 06	waste paint or varnish remover	X
	08 03. Waste from manufacture, formulation, supply and use of printing inks	08 03 03	waste ink containing hazardous substances	X
		08 03 05	ink sludges containing hazardous substances	X
		08 03 07	waste etching solutions	A
		08 03 08	waste printing toner containing hazardous substances	X
		08 03 10	disperse oil	A
	08 04. Waste from manufacture, formulation, supply and use of adhesives and sealants (including waterproofing products)	08 04 01	waste adhesives and sealants containing organic solvents or other hazardous substances	X
		08 04 03	adhesive and sealant sludges containing organic solvents or other hazardous substances	X
		08 04 05	rosin oil	A
		08 04 06	aqueous sludges containing adhesives or sealants containing organic solvents or other hazardous substances	X
09. Waste from photographic industry	09 01. Waste from photographic industry	09 01 01	water-based developer and activator solutions	A
		09 01 02	water-based offset plate developer solutions	A
		09 01 03	solvent-based developer solutions	A
		09 01 04	fixer solutions	A
		09 01 05	bleach solutions and bleach fixer solutions	A
		09 01 06	wastes containing silver from on-site treatment of photographic wastes	X
		09 01 07	photographic film and paper containing silver or silver compounds	A

10. Waste from thermal processes	10 01. Power stations and other compulsion plants (except incinerators)	10 01 01	oil fly ash and boiler dust	A
		10 01 02	bottom ash, slag and boiler dust (excluding boiler dust mentioned in 10 01 01)	X
		10 01 06	sulphuric acid	A
		10 01 07	fly ash from emulsified hydrocarbons used as fuel	A
		10 01 08	bottom ash, slag and boiler dust from co-incineration containing hazardous substances	X
		10 01 10	fly ash from co-incineration containing hazardous substances	X
		10 01 12	wastes from gas cleaning containing hazardous substances	X
		10 01 14	aqueous sludges from boiler cleansing containing hazardous substances	X
		10 01 16	sludges from on-site effluent treatment containing hazardous substances	X
	10 02. Waste from iron and steel industry	10 02 03	solid wastes from gas treatment containing hazardous substances	X
		10 02 05	wastes from cooling-water treatment containing oil	X
	10 03. Aluminum thermal metallurgy	10 03 02	primary production slags	A
		10 03 04	salt slags from secondary production	A
		10 03 06	black drosses from secondary production	A
		10 03 07	skimmings other than those mentioned in 10 03 06	X
		10 03 08	tar-containing wastes from anode manufacture	X
		10 03 10	flue-gas dust containing hazardous substances	X
		10 03 12	other particulates and dust (including ball-mill dust) containing hazardous substances	X
		10 03 14	solid wastes from gas treatment containing hazardous substances	X
		10 03 16	sludges and filter cakes from gas treatment containing hazardous substances	X
		10 03 18	wastes from cooling-water treatment containing oil	X
		10 03 20	wastes from treatment of salt slags and black drosses containing hazardous substances	X

	10 04. Lead thermal metallurgy	10 04 01	slags from primary and secondary production	A
		10 04 02	dross and skimmings from primary and secondary production	A
		10 04 03	calcium arsenate	A
		10 04 04	flue-gas dust	A
		10 04 05	other particulates and dust	A
		10 04 06	solid wastes from gas treatment	A
		10 04 07	sludges and filter cakes from gas treatment	A
		10 04 08	wastes from cooling-water treatment containing oil	X
	10 05. Zinc thermal metallurgy	10 05 02	flue-gas dust	A
		10 05 03	solid waste from gas treatment	A
		10 05 04	wastes from cooling-water treatment containing oil	X
		10 05 06	dross and skimmings that are flammable or emit, upon contact with water, flammable gases in hazardous quantities	X
	10 06. Copper thermal metallurgy	10 06 03	solid wastes from gas treatment	A
		10 06 04	wastes from cooling-water treatment containing oil	X
	10 07. Silver, gold and platinum thermal metallurgy	10 07 04	wastes from cooling-water treatment containing oil	X
	10 08. Other non-ferrous thermal metallurgy	10 08 02	salt slag from primary and secondary production	A
		10 08 04	dross and skimmings that are flammable or emit, upon contact with water, flammable gases in hazardous quantities	X
		10 08 06	anode scrap	X
		10 08 09	flue-gas dust containing hazardous substances	X
		10 08 13	wastes from cooling-water treatment containing oil	X
	10 09. Casting of ferrous pieces	10 09 02	casting cores and moulds which have undergone pouring containing hazardous substances	X
		10 09 04	flue-gas dust	X
		10 09 05	waste binders containing hazardous substances	X
		10 09 07	waste crack-indicating agent containing hazardous substances	X
	10 10. Casting of non-ferrous pieces	10 10 02	casting cores and moulds which have not undergone pouring, containing hazardous substances	X
		10 10 05	waste binders containing hazardous substances	X
		10 10 07	waste crack-indicating agent containing hazardous substances	X

	10 11. Manufacture of glass and glass products	10 11 03	waste preparation mixture before thermal processing, containing hazardous substances	X
		10 11 05	waste glass in small particles and glass powder containing heavy metals	X
		10 11 07	glass-polishing and -grinding sludge containing hazardous substances	X
		10 11 08	solid wastes from flue-gas treatment containing hazardous substances	X
		10 11 10	sludges and filter cakes from flue-gas treatment containing hazardous substances	X
		10 11 12	solid wastes from on-site effluent treatment containing hazardous substances	X
	10 12. . Manufacture of ceramic goods, bricks, tile and construction products	10 12 06	solid wastes from gas treatment containing hazardous substances	X
		10 12 08	wastes from glazing containing heavy metals	X
	10 13. Manufacture of cement, lime and plaster and articles and products made from them	10 13 05	wastes from asbestos-cement manufacture containing asbestos	X
		10 13 08	solid wastes from gas treatment containing hazardous substances	X
	10 14. Waste from crematoria	10 14 01	waste from gas cleaning containing mercury	X
11. Chemical surface treatments of metal/plastic	11 01. Chemical surface treatments and coating of metal and other materials	11 01 01	pickling acids	A
		11 01 02	acids other than specified 11 01 01	A
		11 01 03	pickling bases	A
		11 01 04	phosphatising sludges	A
		11 01 05	sludges and filter cakes containing hazardous substances	X
		11 01 06	aqueous rinsing liquids containing hazardous substances	X
		11 01 07	degreasing wastes containing hazardous substances	X
		11 01 08	eluate and sludges from membrane systems or ion exchange systems containing hazardous substances	X
		11 01 09	saturated or spent ion exchange resins	A
		11 01 10	other wastes containing hazardous substances	X
	11 02. Non-ferrous hydrometallurgy processes	11 02 01	sludges from zinc hydrometallurgy	A
		11 02 03	wastes from copper hydrometallurgical processes containing hazardous substances	X
		11 02 04	other wastes containing hazardous substances	X
	11 03. Sludges and solids from tempering processes	11 03 01	wastes containing cyanide	A
		11 03 02	other wastes	A
	11 04. Waste from coating with zinc	11 04 03	solid wastes from gas treatment	A
		11 04 04	Melted waste	A

12. Shaping / Physical treatment of Metals/Plastic	12 01. Waste from shaping and physical and mechanical surface treatment of metals and plastics	12 01 06	mineral-based machining oils containing halogens or free of halogens, emulsions and solutions	A
		12 01 07	synthetic machining oils	A
		12 01 08	spent waxes and fats	X
		12 01 10	machining sludges containing hazardous substances	X
		12 01 11	spent grinding bodies and grinding materials containing hazardous substances	A
		12 01 12	readily biodegradable machining oil	X
13. Oil and Liquid Fuel Waste (except food, oil refinery and liquid fuel processes)	13 01. Waste hydraulic oils	13 01 01	hydraulic oils, containing PCBs	A
		13 01 02	chlorinated emulsions	A
		13 01 03	non-chlorinated emulsions	A
		13 01 04	mineral-based chlorinated hydraulic oils	A
		13 01 05	mineral based non-chlorinated hydraulic oils	A
		13 01 06	synthetic hydraulic oils	A
		13 01 07	readily biodegradable hydraulic oils	A
		13 01 08	other hydraulic oils	A
	13 02. Waste engine-gear and lubricating oils	13 02 01	mineral-based chlorinated engine, gear and lubricating oils	A
		13 02 02	mineral-based non-chlorinated engine, gear and lubricating oils	A
		13 02 03	synthetic engine, gear and lubricating oils	A
		13 02 04	readily biodegradable engine, gear and lubricating oils	A
		13 02 05	other engine, gear and lubricating oils	A
	13 03. Waste insulting and heat transmission oils	13 03 01	insulating or heat transmission oils containing PCBs	A
		13 03 02	mineral-based chlorinated insulating and heat transmission oils other than those mentioned in 13 03 01	A
		13 03 03	mineral-based non-chlorinated insulating and heat transmission oils	A
		13 03 04	synthetic insulating and heat transmission oils	A
		13 03 05	readily biodegradable insulating and heat transmission oils	A
		13 03 06	other insulating and heat transmission oils	A

	13 04. Oil/Water Separator contents	13 04 01	solids from grit chambers and oil/water separators	A
		13 04 02	sludges from oil/water separators	A
		13 04 03	interceptor sludges	A
		13 04 04	oil from oil/water separators	A
		13 04 05	oily water from oil/water separators	A
		13 04 06	mixtures of wastes from grit chambers and oil/water separators	A
	13 05. Wastes of liquid fuels	13 05 01	fuel oil and diesel	A
		13 05 02	petrol	A
		13 05 03	other fuels (including mixtures)	A
	13 06. Oils wastes not otherwise specified	13 06 01	desalter sludges or emulsions	A
		13 06 02	other emulsions	A
		13 06 09	wastes not otherwise specified	A
14. Solvents, Refrigerants and Propellants	14 01. Waste organic solvents-refrigerants and foam/aerosol propellants	14 01 01	chlorofluorocarbons, HCFC, HFC	A
		14 01 02	other halogenated solvents and solvent mixtures	A
		14 01 03	other solvents and solvent mixtures	A
		14 01 04	sludges or solid wastes containing halogenated solvents	A
		14 01 05	sludges or solid wastes containing other solvents	A
15. Packaging, Absorbents, Wiping, Clothes and Filters,	15 01. Packaging waste	15 01 09	packaging containing residues of or contaminated by hazardous substances	A
		15 01 10	metallic packaging containing a hazardous solid porous matrix (for example asbestos), including empty pressure containers	X
	15 02. Absorbents, filter materials, wiping clothes and protective clothes	15 02 01	absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by hazardous substances	X
16. Other wastes from industrial processes	16 01. End-of-life vehicles from different means of transport and wastes from dismantling of end-of-life vehicles maintenance	16 01 02	end-of-life vehicles	X
		16 01 04	oil filters	A
		16 01 05	components containing mercury	X
		16 01 06	components containing PCBs	X
		16 01 07	explosive components (for example air bags)	A
		16 01 08	brake pads containing asbestos	X
		16 01 10	brake fluids	A
		16 01 11	antifreeze fluids containing hazardous substances	X
		16 01 18	hazardous components other than those mentioned in 16 01 04 to 16 01 08 and 16 01 10 and 16 01 11	X

	16 02. Wastes from electrical and electronic equipment	16 02 01	transformers and capacitors containing PCBs	A
		16 02 02	discarded equipment containing or contaminated by PCBs other than those mentioned in 16 02 01	X
		16 02 03	discarded equipment containing chlorofluorocarbons, HCFC, HFC	X
		16 02 04	discarded equipment containing free asbestos	A
		16 02 05	discarded equipment containing hazardous components other than those mentioned in 16 02 01 to 16 02 04	X
		16 02 07	hazardous components removed from discarded equipment	A
	16 03. Off-specification batches and unused products	16 03 01	inorganic wastes containing hazardous substances	X
		16 03 03	organic wastes containing hazardous substances	X
	16 04. Waste explosives	16 04 01	waste ammunition	A
		16 04 02	fireworks wastes	A
		16 04 03	other waste explosives	A
	16 05. Gases in pressure containers and discarded chemicals	16 05 01	gases in pressure containers containing hazardous substances	X
		16 05 03	laboratory chemicals, consisting of or containing hazardous substances, including mixtures of laboratory chemicals	X
		16 05 04	discarded inorganic chemicals consisting of or containing hazardous substances	X
		16 05 05	discarded organic chemicals consisting of or containing hazardous substances	X
		16 05 06	All container and packages that used to store chemical substances and its compound	X
	16 06. Batteries and Accumulators	16 06 01	lead batteries	A
		16 06 02	Ni-Cd batteries	A
		16 06 03	mercury-containing batteries	A
		16 06 06	other batteries and accumulators	A
	16 07. Wastes from transport tank, storage tank and barrel cleaning	16 07 01	wastes containing oil	X
		16 07 02	wastes containing other hazardous substances	X
	16 08. Spent catalysts	16 08 02	spent catalysts containing scandium, manganite, cobalt, copper, ittrium, columbic, hafnium, wolfram titanium, chrome, iron, nickel, zinc, zirconium, molybdenum, tantalum and its compound	X
		16 08 04	spent catalysts containing phosphoric acid	X
		16 08 05	spent liquids used as catalysts	A
		16 08 07	spent catalysts contaminated with hazardous substances	X

	16 09. Oxidising substances	16 09 01	permanganates, for example potassium permanganate	A
		16 09 02	chromates, for example potassium chromate, potassium or sodium dichromate	A
		16 09 03	peroxides, for example hydrogen peroxide	A
	16 10. Aqueous liquid wastes destined for off-site treatment	16 10 01	aqueous liquid wastes containing hazardous substances	X
		16 10 03	aqueous concentrates containing hazardous substances	X
	16 11. Waste linings and refractories	16 11 01	carbon-based linings and refractories from metallurgical processes containing hazardous substances	X
		16 11 03	other linings and refractories from metallurgical processes containing hazardous substances	X
		16 11 05	linings and refractories from non-metallurgical processes containing hazardous substances	X
	16 12. Carrion of a domestic and non-domestic animals	16 12 02	Animals died due to disease, poisoning and deliberately destroying animal carrion	A
17. Construction and demolition wastes (including excavated soil from contaminated sites)	17 01. Concrete, bricks, tiles and ceramics	17 01 04	mixtures of, or separate fractions of concrete, bricks, tiles and ceramics containing hazardous substances	X
	17 02. Wood, glass and plastic	17 02 04	glass, plastic and wood containing or contaminated with hazardous substances	X
	17 03. Bituminous mixtures, coal tar and tarred products	17 03 01	bituminous mixtures containing coal tar	X
		17 03 03	coal tar and tarred products	X
	17 04. Metals (including their alloys)	17 04 08	metal waste contaminated with hazardous substances	X
		17 04 09	cables containing oil, coal tar and other hazardous substances	X
	17 05. Soil (including excavated soil from contaminated sites), stones and dredging spoil	17 05 01	soil and stones containing hazardous substances	X
		17 05 03	dredging spoil containing hazardous substances	X
		17 05 05	track ballast containing hazardous substances	X
	17 06. Insulation materials and asbestos-containing construction materials	17 06 01	insulation materials containing asbestos	X
		17 06 02	other insulation materials consisting of or containing hazardous substances	X
		17 06 04	construction materials containing asbestos	X
	17 07. Gypsum-based construction material	17 07 01	gypsum-based construction materials contaminated with hazardous substances	X

	17 08. Other construction and demolition waste	17 08 01	construction and demolition wastes containing mercury	X
		17 08 02	construction and demolition wastes containing PCB (for example PCB-containing sealants, PCB-containing resin-based floorings, PCB-containing sealed glazing units, PCB-containing capacitors)	X
		17 08 03	other construction and demolition wastes (including mixed wastes) containing hazardous substances	X
		17 08 04	mixed construction and demolition wastes other than those mentioned in 17 08 01, 17 08 02 and 17 08 03	X
18. Wastes from human or animal health care and/or related research	18 01. Wastes from natal care, diagnosis, treatment or prevention of disease in humans	18 01 02	Body parts and organs including blood bags and blood preserves	A
		18 01 03	wastes whose collection and disposal is subject to special requirements in order to prevent infection	A
		18 01 05	chemicals consisting of or containing hazardous substances	X
		18 01 07	cytotoxic and cytostatic medicines	A
		18 01 09	amalgam waste from dental care	A
		18 01 10	sludges from on-site effluent treatment containing infectious liquid	A
	18 02. Wastes from research, diagnosis, treatment or prevention of disease involving animals	18 02 02	wastes whose collection and disposal is subject to special requirements in order to prevent infection	A
		18 02 04	chemicals consisting of or containing hazardous substances	X
		18 02 06	cytotoxic and cytostatic medicines	A
19. Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use	19 01. Wastes from incineration or pyrolysis of waste	19 01 02	filter cake from gas treatment	A
		19 01 03	aqueous liquid wastes from gas treatment and other aqueous liquid wastes	A
		19 01 04	solid wastes from gas treatment	A
		19 01 05	spent activated carbon from flue-gas treatment	A
		19 01 06	bottom ash and slag containing hazardous substances	A
		19 01 08	fly ash containing hazardous substances	X
		19 01 10	boiler dust containing hazardous substances	X
		19 01 12	pyrolysis wastes containing hazardous substances	X

	19 02. Wastes from physico/chemical treatments of waste (including dechromatation, decyanidation, neutralisation)	19 02 02	premixed wastes composed of at least one hazardous waste	A
		19 02 03	sludges from physico/chemical treatment containing hazardous substances	X
		19 02 05	oil and concentrates from separation	A
		19 02 06	liquid combustible wastes containing hazardous substances	X
		19 02 07	solid combustible wastes containing hazardous substances	X
		19 02 09	other wastes containing hazardous substances	X
	19 03. Stabilised/solidified wastes	19 03 01	wastes marked as hazardous, partly stabilised	A
		19 03 03	wastes marked as hazardous, solidified	A
	19 04. Vitrified waste and wastes from vitrification	19 04 02	fly ash and other flue-gas treatment wastes	A
		19 04 03	non-vitrified solid phase	A
	19 07. Landfill leachate	19 07 01	landfill leachate containing hazardous substances	X
	19 08. Wastes from waste water treatment plants not otherwise specified	19 08 04	saturated or spent ion exchange resins	A
		19 08 05	solutions and sludges from regeneration of ion exchangers	X
		19 08 06	membrane system waste containing heavy metals	X
		19 08 08	grease and oil mixture from oil/water separation containing edible oil and fats	A
		19 08 09	sludges containing hazardous substances from biological treatment of industrial waste water	X
		19 08 11	sludges from biological treatment of industrial waste water other than those mentioned in 19 08 09	X
	19 10. Wastes from shredding of metal-containing wastes	19 10 03	fluff-light fraction and dust containing hazardous substances	X
		19 10 05	other fractions containing hazardous substances	X
	19 11. Wastes from oil regeneration	19 11 01	spent filter clays	A
		19 11 02	acid tars	A
		19 11 03	aqueous liquid wastes	A
		19 11 04	wastes from cleaning of fuel with bases	A
		19 11 05	sludges from on-site effluent treatment containing hazardous substances	X
		19 11 07	wastes from flue-gas cleaning	A

	19 12. Wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified	19 12 06	wood containing hazardous substances	X
		19 12 11	other wastes (including mixtures of materials) from mechanical treatment of waste containing hazardous substances	X
	19 13. Wastes from soil and groundwater remediation	19 13 01	solid wastes from soil remediation containing hazardous substances	X
		19 13 03	sludges from soil remediation containing hazardous substances	X
		19 13 05	sludges from groundwater remediation containing hazardous substances	X
		19 13 07	aqueous liquid wastes and aqueous concentrates from groundwater remediation containing hazardous substances	X
20. Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions	20 01. Separately collected fractions	20 01 06	solvents	A
		20 01 07	acids	A
		20 01 08	alkalines	A
		20 01 09	photochemicals	A
		20 01 10	pesticides	A
		20 01 11	fluorescent tubes and other mercury-containing waste	A
		20 01 12	discarded equipment containing chlorofluorocarbons	X
		20 01 14	oil and fat other than those mentioned in 20 01 13	A
		20 01 17	detergents containing hazardous substances	X
		20 01 18	cytotoxic and cytostatic medicines	A
		20 01 20	discarded electrical and electronic equipment other than those mentioned in 16 02 01 and 16 02 05 containing hazardous components	X
		20 01 22	wood containing hazardous substances	X
		20 03 06	origin unknown carrion of a domestic and non-domestic animals	X
		20 03 07	Ash and soot from incarnation and open burning of mixture of house-hold waste	X

Notes

Hazardous waste is classified as “dangerous” and “controlled” depending on level of hazard and in the table marked as “A” and “X” correspondingly(Mongolian respective word initial letter).

“Dangerous” or “A” marked waste is hazardous waste regardless of volume of toxic contents.

“Controlled” or “X” marked waste shall be classified as dangerous if level of toxic content is higher than the permissible level. If substances’ toxic level not possible to measure /define then automatically mark as “dangerous” waste.

2. Industrial sectors waste normative estimation

Type of Waste Sources	Calculation Unit
Apartments and Dormitories	per head
Hotels and Resorts	per bed
Kindergartens, Day-care centers	per child
Universities and Schools	per student
Science and Research Institutions	per employee
Libraries and Museums	per employee
Movie theater, Cultural Center	per sit
Stadium, Sports Palace	per sit
Churches/Temples and Public Recreational area clearance	1 m^2 area
Shopping Malls, Markets, and Retail Services	1 m^2 area
Restaurant, Pub, coffee shop	per costumer
Warehouse	1 m^2 area
Barber shop, Public catering establishment, shoe repair, clothing repair, sewing workshop	per employee
Offices, workrooms	per employee
Railway stations, Bus terminal, Airport	1 m^2 area
Health organizations	per bed performance stock and per examination
Public squares and streets, parks, public recreational area	1 m^2 area
Military units	per serviceman
Industry	capacity and unit production
Construction and demolition	1 m^2 area
Animal husbandry	cattle number

Business entity and organization’s daily waste normative shall calculate by using above table provided calculation unit. The waste normative is an annual generated waste volume divided by product of calculation unit and total working days

$$V^{31} = L / (N \times A)$$

V – waste normative

L – annual waste volume

N – calculation unit

A – total working days in year

This methodology to calculate the amount of annual waste volume is not to differ more than 5% of the real generated annual amount of waste. If the difference of estimation and real waste amount is 5 % or above then the normative should be revalue.

The estimation methodology of daily amount of waste is provided in chapter 2 of the document. Daily amount waste estimation is based on measurements and contacted number of days in the selected household and business entities.

31 Hazardous waste classifications system in Mongolia, Resolution no. 263 dated 29 June 2015 signed by Prime Minister and Minister of MEGDT.

3. Field Survey Visit Report

UNIDO PAGE Industrial Waste Inventory

Date: 22-26 June 2015

Ulaanbaatar, Mongolia

1. Names: Mr. Guilberto Borongan (Programme Specialist), AIT RRC.AP

   Mr. Bayasgalan Sanduijav (Programme Specialist), AIT RRC.AP

2. Period of Travel: 21-27 June 2015

3. Field visit site/place: Ulaanbaatar and Countryside of Mongolia

4. Project: UNIDO PAGE Industrial Waste Inventory

5. Main persons visited and contacted [agency/organizations]:

S.N.	Name/Designation/Organization
1.	Ms. Sandag Regzedmaa, Senior Officer of Light and Industry Policy and Regulation Department and Specialist in charge of recycling and packaging industry, Ministry of Industry
2.	Ms. Bulgan, Director, Ministry of Environment, Green Development and Tourism (MEGDT)
3.	Ms. Erdenebayasgalan Ganjuurjav, Specialist, Environment and Natural Resource Management Department, MEGDT
4.	Mr. Tsogtbaatar Choijinzav, Senior Specialist, Strategic Policy and Planning Department, Ministry of Mining
5.	Ms. Ayako Maruyama, Project Formulation Adviser, JICA
6.	Ms. Altantsetseg Sodnomtseren, National PAGE Coordinator
7.	Mr. Achim Halpaap, Manager, Environmental Governance Program, UNITAR
8.	Mr. Gombodash Tumenjargal, Head of Sustainable Production and Consumption Department, Mongolian National Chamber of Commerce and Industry
9.	Ms. Ariunaa Norovsambuu, Urban Services Program Coordinator, The Asian Foundation
10.	Ms. Chimeg Junai, Programme Analyst, UNDP
11.	Mr. Amarsanaa B., Member of the Board of Directors, Mongolian National Recycling Association
12.	Ms. Bulganmurun Tsevegjav, Senior Program Officer, Green Growth Planning and Implementation, Global Green Growth Institute
13.	Mr. Batbayar T., Head, Public Services Dept., Mayor's Office, Ulaanbaatar City
14.	Mr. B. Badral, General Manager of Ulaanbaatar City and Head of Mayor's Office
15.	Mr. Ariguun, SWM Dept., Ulaanbaatar City
16.	Mr. Bat-ochir Mendbayar, Vice President, Mongolian Association of Leather Industry
17.	Ms. Erdenesan Eldev-Ochir, Director, Macro-economics statistics department, National Statistical Office of Mongolia
18.	Ms. Khandarmaa,Policy implementation and coordination for chemical safety, Ministry of Health
19.	Ms. Tsermaa Gerden, Construction and Building Material, Policy Implementation and Coordination Department, Ministry of Construction and Urban Development

Objectives of the field survey visit:

The objectives of our visit to Ulaanbaatar and the countryside of Mongolia are to build and strengthen the partnership between the different line ministries and agencies in Mongolia (in particular the Ministry of Environment, Green Development and Tourism) and the relevant UN agencies/partners. Partnership will be strengthened through the PAGE (Partnerships for Action on Green Economy) programme, which is associated with Industrial Waste Inventory in Mongolia for assessment of the waste management and industrial waste inventory under the framework of the PAGE programme. AIT RRC.AP is responsible in playing a bridging role between the relevant stakeholders and the UNIDO PAGE by providing coordination and technical assistance in the Industrial Waste Inventory. Other objectives include the collection of preliminary data and information in terms of waste quantification, characterization and projections, current industrial waste management and identification of gaps therein including institutional arrangements, legislative framework and implementation, financing mechanisms, technology and infrastructure, and stakeholders' roles.

Summary

- Ministry of Industry: The Ministry of Industry was newly established in 2014. The ministry is responsible in the recycling sector, covering the recycling and packaging industries. The act/law developed by the ministry is now under approval by the parliament. Currently, there are 13 recycling industries (e.g. used oil/cooking oil to produce bio-diesel, plastic/paper/tire/glass recycling). The Ministry of Industry informed that the ministry was not invited to the PAGE Programme Workshop held on 15-19 June 2015. The Ministry requested UNIDO to support recycling activities in Mongolia.

- Ministry of Mining: Currently, there are about 1,500 active mining companies with special permission, 400 of which are large-scale companies. Mining activities in Mongolia include extraction of gold, copper, coal, limestone, among other minerals. 20% of the GDP in Mongolia is contributed from the mining sector while 90% of the products that are for export, come from the mining industry. For coal enrichment 50 million tons are produced per year where remaining are 20% waste. The 10 types of minerals in Mongolia include: Cu, Coal, Fe, Au, fluorspar [CaF2], Molybdenum, Ag, Tungsten, Sn and crude oil.

- MEGDT: The specific areas of PAGE support in Mongolia include the green economy modeling and policy assessment, green development indicators, sustainable public procurement, green schools, national waste management strategy and green economy learning strategy. Ms. Bulgan, MEDGT indicated that it seems there is a gap of communication and coordination with the UNIDO PAGE IWI, since the ministry was not informed that RRC.AP will be contracted to undertake the industrial waste inventory in Mongolia. UNITAR clarified about the UNIDO PAGE IWI project.

- JICA: Currently, there is no existing technical assistance on waste management in Mongolia. JICA informed that the MoU between the Ministry of Environment of Japan and the Government of Mongolia on waste management and 3Rs has already been signed.

- Ulaanbaatar Mayor's Office: The Mayor's office of Ulaanbaatar expressed interest with the UNIDO PAGE IWI. The city is keen to support by providing land for the proposed Eco-Industrial Park proposed by the Mongolian National Recycling Association. The head requested for support for the existing wastewater treatment in Ulaanbaatar which is a pressing issue and problem for the city of Ulaanbaatar.

- National Chamber of Commerce: The agency is responsible for supporting sustainable consumption and production (SCP). Current programmes include the promotion of green

technology as well as supporting green business in industries. The agency is supporting the small business with priority on the mining sector.

- Global Green Growth Initiative: Parliament has approved the strategies on green development. The initiative contributed one chapter in the strategy. Current activities of the initiative include green financing, capacity building through training and technology transfer.

- Ministry of Construction and Planning: The Ministry is responsible for the waste stream of construction and demolition waste. Currently there is a construction boom in Mongolia, particularly in the city of Ulaanbaatar, however there is no existing framework or regulations addressing C&D waste as well initiatives on C&D waste recycling and no available data on C&D waste generation as well as the type of C&D waste. Recently it has also been observed that the demolition waste from old buildings contains asbestos, which is toxic for humans. A Special Inspection Agency is currently drafting rules and regulations in the management of C&D waste from collection, transportation, treatment, recovery and disposal. Ulaanbaatar has a special disposal for C&D waste, however, the reuse of demolition waste has not been approved by the government as there is no available standard.

- Field visit with MNRA at 2 proposed Eco-Industrial parks: The proposed Eco-industrial parks at Tsagaan Davaa and Narangyn Enger were visited. Tsagaan Davaa land area is 92 hectares with an open dumping site and recycling facility. The open dumping site in Tsagaan Davaa has been operating for 3 years to accommodate municipal waste in Ulaanbaatar City with 60 locals working at the site. Narangyn Enger site land area is 172 hectares, with a controlled landfill accommodating waste up to 2020.

- Global Green Growth Institute: GGGI is an international organization established on 2012, focusing on green growth and resource efficiency. RRC.AP briefed about the UNIDO PAGE Industrial Waste Inventory Project. The Institute explored potential and future opportunities and collaboration on industrial waste activities in Mongolia under PAGE framework.

- The Asia Foundation: The Current activities on the program of Urban Services in the Ger Districts of Ulaanbaatar include improving solid waste management, with duration from May 2012 to August 2015. Partners include the City of Ulaanbaatar and the Ger Area districts. The program is supported by AusAID. A new amendment on the existing SWM regulations in Ulaanbaatar was approved in May 2015. Management challenges on SWM include unclear city structure, with weak lines of accountability and limited information.

- Tannery, Leather and Apparel Association: Currently, there are 34 tanneries in Mongolia, 32 of which are located in Ulaanbaatar and 2 located in the outskirts of Ulaanbaatar, in addition to this there are 90 factories for leather and apparels production. After privatization of the tanneries, recycling operation was lost, leading to most of the waste streams from the tanneries being dump somewhere in Ulaanbaatar. The Association requested assistance to upgrade the tanneries, as most of the factories' equipment and facilities are outdated and only traditional technology is used. The Tannery Research Institute is submitting a proposal to reduce the waste in the tannery sector.

- Field visit to the Tannery factory: The tannery park land area consists of 30 hectares. The factory that was visited, disposes their waste containing lead and chromium, in canals without treatment. Poor occupational health was observed within the factory, and it was found that ammonium is released during the operation, where workers do not have safety gear e.g. mask and gloves, as well poor ventilation in the facility. No proper housekeeping within the factory was noticed. The 26 other tanneries are in similar situation, while 6 of the other tanneries have advanced technology to treat their waste.

- Field visit with the Gold Mining Company: Ten Khun Corporation (Chinese Owned Company): The factory is using Cyanide in the extraction of Gold. The company has a waste treatment system particularly for the CN waste water. Since the mining area is a special zone for vegetation and agriculture, the company is treating wastewater containing CN to reduce 5-10 ppm which is below the state standard of 25 ppm. The company started its operation in 2011, with an area capacity to mine of about 265,000 cubic meters. Chemical substances that are used in the in the mining plant include CN, HNO_3, $Ca(OH)_2$, NaCl, $Na2CO_3$, $H_20_4C_2$, CaO. One of the pressing issues of the mining plant is where to dispose CN packaging material, since there is no available special landfill to contain the CN packaging waste material.

- Ministry of Health: Currently the data and information on healthcare waste is not updated. The ministry is updating the HCW including the generation, infrastructure and disposal. Old mercury thermometer has been completely phased out in Mongolia, especially to healthcare facilities. The ministry has a project which is currently in phase 5 in HCW implementation. The partners of the project are MOH, ADB and WHO.

- UNDP: Currently UNDP is developing a concept on waste management - "turning waste to gold". This project will be implemented at residential level, which includes awareness raising on separation of waste and 3Rs through composting activities. The fund will be from innovation fund project amounting to US$ 30,000. This proposed project is not under the PAGE program.

- National Statistical Office of Mongolia. The National Statistic Office provided valuable data and information on the current [2014] geo-demographical and administrative information in Mongolia [Population, socio-economic status, foreign investment, markets and current net imports/exports].

Recommendation(s)/actions to be taken:

Based on the discussion with officials of various line ministries/agencies in Mongolia and other relevant PAGE partners considering their keen interest in improving industrial waste management in Mongolia, it is recommended to work closely with the Ministry of Environment, Green Development and Tourism in undertaking the industrial waste inventory. AIT RRC.AP has provided the template for the data needed for Industrial Waste Inventory. RRCAP will need to follow up with the line ministries and other relevant stakeholders associated with waste management and industrial waste inventory. UNIDO is requested to communicate with MEGDT about AIT RRC.AP's engagement with Industrial Waste Inventory project in Mongolia.

Annexures

1. Documents, reports and brochures/leaflets were received from the relevant stakeholders.

2. Documentations/Photo attachments [photos during the field visit/meeting]

PAGE PARTNERSHIP FOR ACTION ON GREEN ECONOMY

The Partnership for Action on Green Economy (PAGE) supported the Mauritian government in the identification of the industrial wastes that could become part of industrial symbiosis programmes. The outcome of this industrial waste assessment provides the quantification at the national scale of different waste types - generated in the main selected industries of Mauritius - that can be reused, recycled or from which energy can be recovered, by the same or a different industry. Specific opportunities to set up industrial symbiosis activities and expand the sectors of recovery from waste are identified. The review of the legislative and institutional framework for waste management identified constraints impacting on the recovery of materials and energy from industrial solid waste. A set of recommendations – giving relevance to discussions involving several stakeholders - is presented addressing relevant policy issues.

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