DELIVERABLE 2.1
"WASTE MANAGEMENT IN CASE STUDY REGION: MOGILEV CITY AND MOGILEV DISTRICT"

"Waste management in transition economies"

WaTra

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List of abbreviations

AIS	Automatized information system
BSSR	Byelorussian Soviet Socialist Republic
CDIAC	Carbon Dioxide Information Analysis Center
EBRD	European Bank for Reconstruction and Development
EPR	Extended producer responsibility
EU	European union
EurAsEC	Eurasian Economic Community
GDP	Gross Domestic Product
HBC	Housing building cooperatives
HPU	Housing and public utilities
JSC	Joint stock company
ME	Ministry of energy
MES	Ministry of emergency situations
MHPU	Ministry of housing and public utilities
MI	Ministry of Industry
MNREP	Ministry of natural resources and environmental protection
MT	Ministry of trade
MPC	Maximum permissible concentration
MSW	Municipal solid waste
MUE	Municipal unitary enterprise
NGO	Non-governmental organization
POPs	Persistent organic pollutants
RD of HPU	Regional department of housing and public utilities
R&D	Research and development
RSFSR	Russian Soviet Federative Socialist Republic
SAE	Special automobile enterprise
SME	Small and medium enterprises
SRM	Secondary raw materials
SUE	State Unitary Enterprise
SU	State union
UNDP	United nations development programme
UNFCCC	United Nations Framework Convention on Climate Change
UN	United nations
USSR	Union of Soviet Socialist Republics
WIP	Waste Incineration Plant
WM	Waste management
WTP	Waste treatment plant

Abstract

Current report represents the overview of WM in post-Soviet countries – Belarus, Russia and Kazakhstan. Report was developed by team of Belarusian researchers. Overview of every country is divided into 2 parts: before 1990 and after 1990. All descriptions have the similar structure and include overall background, legal and institutional framework of WM, performances of WM system (in regards to life cycle of waste – generation, collection and transportation, treatment, recycling, landfilling), legal and economic instruments of WM, financing of WM system, public and communication initiatives, and in the end, barriers and success factors for WM improvement.

Countries had the similar basement of WM system which was developed in 1980s in the USSR. After the end of Soviet era every country made own choice of the development of WM system. In spite of different policies and economic instruments and almost 30 years of independent development, WM system of 3 counties has strong soviet legacy: landfilling as a main approach to deal with MSW, existing landfills do not meet environmental requirements; the issue of illegal dumping and numerous mini-dumps near every settlement is very stressful factor of WM, lack of attention to hazardous waste from households; inefficient tariff and pricing policy. All countries face the similar problems related to almost destroyed system of SRM collection from population; lack of sound policy; gaps and mismatches in institutional and economic instruments of WM; imperfect legislation and reporting system. At the same time, every country has specific barriers and success factors of WM, which are concluded every overview.

Special part of report is dedicated to detailed description of Mogilev city and Mogilev district. All specific performances of WM system are described and analyzed based on statistic data, reports of WTP and RD of HPU and Regional committee of MNREP as well as interviews with representatives of state agencies, local self-governmental bodies, enterprises operated in the field of collection and transportation, treatment and landfilling, recycling of MSW, as well as with locals living in Mogilev city and in village in Mogilev district.

Conclusions and results of report will be used for scenario development for Belarus and in particular for Mogilev city and Mogilev district.

1 Waste management in Belarus

1.1 OVERALL BACKGROUND

After seven decades as a constituent republic of the USSR, Belarus attained its independence in 1991. It has retained closer political and economic ties to Russia than have any of the other former Soviet republics. Belarus and Russia signed a treaty on a two-state union on 8 December 1999 envisioning greater political and economic integration. Although Belarus agreed to a framework to carry out the accord, serious implementation has yet to take place. Since his election in July 1994 as the country's first directly elected president, Aleksandr LUKASHENKO has steadily consolidated his power through authoritarian means and a centralized economic system.

1.1.1 Country profile

Tab. 1.1.1: General information about Belarus*

Location	Eastern Europe, east of Poland
Area	total: 207600 km^2 land: 202900 km^2 water: 4700 km^2
Land boundaries	total: 3599 km border countries: Latvia 161 km, Lithuania 640 km, Poland 375 km, Russia 1312 km, Ukraine 1111 km
Climate	cold winters, cool and moist summers; transitional between continental and maritime
Terrain	generally flat and contains much marshland
Elevation extremes	lowest point: Nyoman River 90 m, highest point: Dzyarzhynskaya Hara 346 m
Natural resources	timber, peat deposits, small quantities of oil and natural gas, granite, dolomitic limestone, marl, chalk, sand, gravel, clay
Land use	arable land: 26,63 % permanent crops: 0,59 % other: 72,78 % (2011)
Irrigated land	1150 km^2 (2003)
Total renewable water resources	58 km^3 (2011)
Freshwater withdrawal (domestic/industrial/agricultural)	total: 4,34 km^3/yr (32%/65%/3%) per capita: 435,4 m^3/yr (2009)
Environment - current issues	soil pollution from pesticide use; southern part of the country contaminated with fallout from 1986 nuclear reactor accident at Chornobyl' in northern Ukraine

* (web-site Index Mundi)

1.1.2 Development of economic and environmental situation

Tab. 1.1.2: Demographic and social profile of Belarus*

Population	9608058 (July 2014)
Age structure	0-14 years: 15,4% (male 759285/female 717118) 15-24 years: 11,7% (male 575907/female 544170) 25-54 years: 45,5% (male 2141419/female 2227433) 55-64 years: 13,3% (male 562639/female 716216) 65 years and over: 14,2% (male 430225/female 933646) (2014)
Median age	total: 39,4 years male: 36,3 years female: 42,4 years (2014)
Life expectancy at birth	total population: 72,15 years male: 66,53 years female: 78,1 years (2014)
Population growth rate	-0,19% (2014)
Birth rate	10,86 births/1000 population (2014)
Death rate	13,51 deaths/1000 population (2014)
Infant mortality rate	total: 3,64 deaths/1000 live births male: 4,07 deaths/1000 live births female: 3,19 deaths/1000 live births (2014)
Net migration rate	0,78 migrant(s)/1000 population (2014)
Urbanization	urban population: 75% of total population (2011) rate of urbanization: 0,21% annual rate of change (2010-15 est.)
Mother's mean age at first birth	25,1 (2011)
Total fertility rate	1,47 children born/woman (2014)
Ethnic groups	Belarusian 83,7%, Russian 8,3%, Polish 3,1%, Ukrainian 1,7%, other 2,4%, unspecified 0,9% (2009)
Religions	Eastern Orthodox 80 %, other (including Roman Catholic, Protestant, Jewish, and Muslim) 20 % (1997)
Languages	Belarusian (official) 23,4 %, Russian (official) 70,2 %, other 3,1 % (includes small Polish- and Ukrainian-speaking minorities), unspecified 3,3% (2009)
Literacy	total population: 99,6 % male: 99,8 % female: 995 % (2009)
School life expectancy (primary to tertiary education)	total: 16 years
Education expenditures	5,1 % of GDP (2012)
Health expenditures	5,3 % of GDP (2011)
Physicians density	3,76 physicians/1000 population (2011)
Hospital bed density	11,1 beds/1000 population (2011)
Obesity - adult prevalence rate	24,3 % (2008)
Children under the age of 5 years underweight	1,3 % (2005)
Drinking water source	improved: urban: 99,8 % of population rural: 99 % of population total: 99,6 % of population

Sanitation facility access	improved: urban: 94 % of population rural: 95,3 % of population total: 94,3 % of population

* (web-site Index Mundi)

Economic situation

As part of the former Soviet Union, Belarus had a relatively well-developed industrial base; it retained this industrial base - which is now outdated, energy inefficient, and dependent on subsidized Russian energy and preferential access to Russian markets - following the breakup of the USSR. The country also has a broad agricultural base which is inefficient and dependent on government subsidies. After an initial burst of capitalist reform from 1991-94, including privatization of state enterprises, creation of institutions of private property, and development of entrepreneurship, Belarus' economic development greatly slowed. About 80 % of all industry remains in state hands, and foreign investment has been hindered by a climate hostile to business. A few banks, which had been privatized after independence, were renationalized. State banks account for 75 % of the banking sector. Economic output, which had declined for several years following the collapse of the Soviet Union, revived in the mid-2000s thanks to the boom in oil prices. Belarus has only small reserves of crude oil, though it imports most of its crude oil and natural gas from Russia at prices substantially below the world market. Belarus exported refined oil products at market prices produced from Russian crude oil purchased at a steep discount. In late 2006, Russia began a process of rolling back its subsidies on oil and gas to Belarus. Tensions over Russian energy reached a peak in 2010, when Russia stopped the export of all subsidized oil to Belarus save for domestic needs. In December 2010, Russia and Belarus reached a deal to restart the export of discounted oil to Belarus. Little new foreign investment has occurred in recent years. In 2011, a financial crisis began, triggered by government directed salary hikes unsupported by commensurate productivity increases. The crisis was compounded by an increased cost in Russian energy inputs and an overvalued Belarusian ruble, and eventually led to a near three-fold devaluation of the Belarusian ruble in 2011. In November 2011, Belarus agreed to sell to Russia its remaining shares in “Beltransgaz”, the Belarusian natural gas pipeline operator, in exchange for reduced prices for Russian natural gas. Receiving more than half of a $3 billion loan from the Russian-dominated Eurasian Economic Community (EurAsEC) Bail-out Fund, a $1 billion loan from the Russian state-owned bank “Sberbank”, and the $2,5 billion sale of “Beltranzgas” to Russian state-owned “Gazprom” helped stabilize the situation in 2012; nevertheless, the Belarusian currency lost more than 60 % of its value, as the rate of inflation reached new highs in 2011 and 2012, before calming in 2013. As of January 2014, the final tranche of the EurAsEC loan has been delayed, but in December 2013 Russia announced a new loan for Belarus of up to $2 billion for 2014. Notwithstanding foreign assistance, the Belarusian economy continues to struggle under the weight of

high external debt servicing payments, a growing trade deficit, stagnant economic growth, and low foreign reserves. Some economic data is represented in the Tab. 1.1.3.

Tab. 1.1.3: Economic profile of Belarus*

GDP (purchasing power parity)	$150,4 billion (2013) $147,3 billion (2012) $145 billion (2011) note: data are in 2013 US dollars
GDP (official exchange rate)	$69,24 billion (2013)
GDP - real growth rate	2,1 % (2013) 1,5 % (2012) 5,5 % (2011)
GDP - per capita (PPP)	$16 100 (2013) $15 700 (2012) $15 400 (2011) note: data are in 2013 US dollars
Gross national saving	24,8% of GDP (2013) 31,8% of GDP (2012) 29,2% of GDP (2011)
GDP - composition, by end use	household consumption: 46,3 % government consumption: 15,3 % investment in fixed capital: 30 % investment in inventories: 0,7 % exports of goods and services: 80,2 % imports of goods and services: -72,5 % (2013)
GDP - composition by sector	agriculture: 9,2 % industry: 46,2 % services: 44,7 % (2013)
Population below poverty line	27,1 % (2003)
Labor force	5 million (2009)
Labor force - by occupation	agriculture: 9 4 % industry: 45 9 % services: 44 7 % (2005)
Unemployment rate	1 % (2009) 1,6 % (2005) note: official registered unemployed; large number of underemployed workers
Unemployment, youth ages 15-24	total: 12,6 % male: 12,4 % female: 12,6 % (2009)
Household income or consumption by percentage share	lowest 10 %: 3,8% highest 10 %: 21,9% (2008)
Distribution of family income - Gini index	27,2 (2008) 21,7 (1998)
Budget	revenues: $26,68 billion expenditures: $26,79 billion (2013)
Taxes and other revenues	38,5 % of GDP (2013)
Budget surplus (+) or deficit (-)	-0,2 % of GDP (2013)

Public debt	31,5 % of GDP (2013) 31,5 % of GDP (2012)
Inflation rate (consumer prices)	19 % (2013) 59,1 % (2012)
Central bank discount rate	10,5 % (31 December 2010) 13,5 % (31 December 2009)
Commercial bank prime lending rate	10 % (31 December 2013) 19,49 % (31 December 2012)
Stock of narrow money	NA % (31 December 2013) $4,018 billion (31 December 2012)
Stock of broad money	$9,073 billion (31 December 2013) $7,655 billion (31 December 2012)
Stock of domestic credit	$22,68 billion (31 December 2013) $19,82 billion (31 December 2012)
Agriculture - products	grain, potatoes, vegetables, sugar beets, flax; beef, milk
Industries - products	metal-cutting machine tools, tractors, trucks, earthmovers, motorcycles, televisions, synthetic fibers, fertilizer, textiles, radios, refrigerators
Industrial production growth rate	1 % (2013)
Current Account Balance	-$4,245 billion (2013) -$1,688 billion (2012)
Exports	$42,06 billion (2013) $45,57 billion (2012)
Exports - commodities	machinery and equipment, mineral products, chemicals, metals, textiles, foodstuffs
Exports - partners	Russia 35,4 %, Netherlands 16,4 %, Ukraine 12,1 %, Latvia 7,1 % (2012)
Imports	$45,17 billion (2013) $45,01 billion (2012)
Imports - commodities	mineral products, machinery and equipment, chemicals, foodstuffs, metals
Imports - partners	Russia 59,4 %, Germany 5,9 %, China 5,1 %, Ukraine 5 % (2012)
Reserves of foreign exchange and gold	$4,513 billion (31 December 2013) $5,809 billion (31 December 2012)
Debt - external	$1,204 billion (31 December 2013) $1,225 billion (31 December 2012)

* (web-site Index Mundi)

Environmental situation

Environmental footprint of Belarus is briefly represented in Tab. 1.1.4.

Tab. 1.1.4: Environmental footprint of Belarus

Year	Carbon dioxide emissions (CO_2), kg CO_2 per $1 GDP (UNFCCC)	Carbon dioxide emissions (CO_2), metric tons of CO_2 per capita (UNFCCC)	Carbon dioxide emissions (CO_2), thousand metric tons of CO_2 (UNFCCC)	Consumption of all Ozone-Depleting Substances in ODP metric tons	Energy use (kg oil equivalent) per $1,000 GDP	Terrestrial and marine areas protected to total territorial area, %	Terrestrial and marine areas protected, sq. km.
1990	1,56	10,1	103806,8	1554,3	684	6,55	13566
1991	1,48	9,5	97475,4	1451,2	674	6,65	13780
1992	1,52	8,7	90060,2	1161,9	622	6,66	13801
1993	1,41	7,5	77204,2	1161,5	574	6,82	14138
1994	1,33	6,3	64506,2	1007,3	552	6,84	14179
1995	1,33	5,6	57599,8	595,3	570	7,17	14850
1996	1,31	5,7	58553,8	599,8	568	7,22	14962
1997	1,2	5,9	59868	418,4	509	7,22	14962
1998	1,08	5,7	58064,8	278,9	460	7,22	14962
1999	0,99	5,5	55404,1	208,3	433	7,22	14962
2000	0,9	5,3	53319,3	16,8	418	7,22	14962
2001	0,85	5,2	52347	9,3	401	7,22	14962
2002	0,81	5,3	52528,8	2,7	389	7,22	14962
2003	0,76	5,3	52888,4	4,5	374	7,22	14962
2004	0,73	5,7	56258,5	3,1	347	7,22	14963
2005	0,68	5,8	56669,8	0,6	322	7,22	14964
2006	0,64	6,1	59128,5	1,3	310	7,22	14964
2007	0,58	6	58280	0,8	277	7,22	14964
2008	0,54	6,2	60365,4	0,4	250	7,22	14964

1.2 WASTE MANAGEMENT SITUATION IN BELARUS BEFORE 1990

1.2.1 Overall background

The Byelorussian Soviet Socialist Republic was declared on 1st of Jan, 1919 and named as Soviet Socialist Republic of Byelorussia. It left the RSFSR, and formed the union with the Lithuanian Soviet Republic (the SSR LitBel) on 27th of Feb, 1919. In the result of the Moscow agreement between RSFSR and Lithuania, the SSR LitBel was de facto abolished on 12th of July, 1920. LitBel de jure became extinct on 31st of July, 1920, when the Soviet Socialist Republic Byelorussia was re-established and renamed to the Byelorussian Soviet Socialist Republic. The BSSR (among other fourth soviet republics) signed the Treaty on the Creation of the USSR on 30th of December, 1922. The Declaration of State Sovereignty of the Belarusian Soviet Socialist Republic was

adopted on 27th of July, 1990. BSSR was renamed to The Republic of Belarus on 19 September. Agreement Establishing the Commonwealth of Independent States was signed on 8th of December, 1991 together with Russia and Ukraine. Together with Russia and Ukraine Byelorussian SSR were a co-founder and member of the UN from 1945.

The economy of the BSSR. The energy sector was based on gas, oil (masut), peat, coal. Oil and peat production was carried out. The leader position in overall production had machine building and metal working production in particular automobile industry and tractor construction industry. Such industries as instrumental making, the radio engineering and radio electronic were well developed. The chemical and petrochemical industry had specialization in the production of mineral fertilizers, tires, plastic mixtures and synthetic materials, chemical fibers. The textile, knitting, leather and foot industries had high level of development also. In the 1970-80s the economy of BSSR as economy of the USSR in the whole began slowing down its rates. In 1982 average annual increase in the national income was 3,4 %. Huge money was invested in new projects which quite often were not finished. The technical level of BSSR became far behind the developed countries. The development of agriculture was contradictory. On the one hand the material and technical basis was increasing, on the other hand the rates of development of the agricultural industry was slowing down. The quantity of unprofitable industries was going up. Available data on demographic, social and economic situation in BSSR is shown in the Tab. 1.2.1.

Tab. 1.2.1: Social and economic profile of BSSR*

Indicator	1980	1990
Population, ths per		10260
Life expectancy at birth Total Men Women		 71,3 66,4 75,9
Rate of birth, per 1000	16,0	13,9
Rate of dearth, per 1000	9,9	10,7
Population growth rate	6,1	3,2
Infant mortality per 1000	16,3	11,9
Urbanization, %		66,4
Average family size, per		3,2
Average monthly incomes, rub	150,0	264,5
Labor force, ths per	4046	4236
GDP, mln $		17370
GDP per capita, $		1686
GDP structure: Industry Agriculture Services		 47 24 29
Retail turnover, mln rub	9909	19145

* (Economy of the USSR in 1990)

1.2.2 Legal and institutional framework of waste management

The law on land protection was adopted in the USSR in 1968. It was the first law on environmental protection in the country. Later other environmental laws were developed and approved. Soviet environmental legislation had focus on management of natural resources (land, water, forests and air). Only law on atmosphere protection included articles about control of emissions, pollutions and protection of environment. All other laws regulated environment protection in general words.

In general, there was not a special law on WM. The legislation in the sphere of WM had focus on SRM, their collection and utilization. The main point was establishment of economic instruments for utilization of SRM, especially metals. For example:

- *Letter of Ministry of finances of the USSR from 30.06.1975 № 65 "On the order of payments to the budget for waste and scrap of ferrous and non-ferrous metals"*;
- *Letter of Ministry of finances of the USSR from 25.12.1975 № 119 "On the calculations of public specialized organizations "Vtorchermet" and "Vtortsvetmet" for waste and scrap of ferrous and non-ferrous metals, handed over schools and other institutions, consisting on a budget"*;
- *Resolution of the Council of Ministers from 12.10.1977 № 910 "About bonus payment to employees for collection, storage, delivery and shipment of scrap and waste of ferrous and nonferrous metals"*.

In 1977 the first technical standard on development and design of landfills was established: *Sanitary rules of design, construction and operation of landfills for non-utilized industrial waste (Appr. Ministry of Health of the USSR 22.08.1977 № 1746-77)*.

In the end of 1970s and beginning of 1980s the development and improving environmental legislation was continued. At the same time changes in environmental legislation did not have principle character. In that time economic interests were in the top priority, and environmental legislation did not have strong instruments for nature protection. Environmental legislation was inefficient. The enforcement was another weak point of environmental legislation. In regards to WM in the end of 1970s and beginning of 1980s the focus on collection and utilization of SRM was saved:

- *Resolution of the Council of Ministers from 25.01.1980 № 65 "On measures to further improving the use of recycled materials in the national economy"*;
- *Resolution of the Central Committee of Communist Party of Soviet Union and Council of Ministers from 23.07.1981 № 715 "On measures for further improvement of the processing (delivery), and scrap recycling non-ferrous metal waste and increase the technical level of the secondary non-ferrous metallurgy enterprises"*;
- *Resolution of the Council of Ministers from 04.11.1982 № 965 "On the improvement of industrial use (business) of ferrous waste"*;

- *Resolution of the Central Committee of Communist Party of Soviet Union and Council of Ministers from 16.01.1985 № 57 "On the improvement of the use of non-ferrous metals in the economy, further development and improvement of the technical level of the secondary non-ferrous metal industry"*;
- *The sanitary rules on production and quality assessment of paper and cardboard produced with the use of recycled paper and are intended to pack dry food products (Appr. Ministry of Health of the USSR 20.05.1986 № 4105-86)*.

The sanitary standard on collection, storing, transportation and utilization of SRM was established in 1982: *Sanitary rules for the collection, storage, transport and primary processing of secondary raw materials (Appr. Ministry of Health of the USSR 22.01.1982 № 2524-82)*.

In the beginning of 1980s the first regulations on management of hazardous waste were adopted:

- *Limit amount of toxic compounds in industrial waste that makes the assignment of these wastes to the category of toxicity (Appr. Academy of Science of the USSR 27.12.1984, Ministry of Health of the USSR 18.12.1984 № 3170-84*);
- *Procedure for storage, transportation, disposal and dumping of toxic industrial waste (sanitary rules) (Appr. Ministry of Health of the USSR 29.12.1984 № 3183-84*);
- *Resolution of the Council of Ministers from 15.02.1980 № 143 "On measures for further improvement of the organization of the collection and use of oil wastes"*;
- *Limit amount of accumulation of toxic industrial waste at the territory of the enterprise (organization) (Appr. Chief State Sanitary Doctor of the USSR 01.02.1985 № 3209-85, Ministry of Water Resources of the USSR 21.02.1985 № 13-3-5/178, USSR Ministry of Geology 02.01.1985*);
- *Guidelines for the control of the organization of current and final demercurisation and evaluation of its effectiveness (Appr. Ministry of Health of the USSR 31.12.1987 № 4545-87*);
- *Sanitary rules on work with mercury, its compounds and mercury-filled devices (Appr. Chief State Sanitary Doctor of the USSR 04.04.1988 № 4607-88*).

The first Cadaster of toxic waste was adopted in 1987: *Temporary classifier of toxic industrial wastes and guidelines for the definition of the toxicity class of industrial waste (Appr. Ministry of Health of the USSR 13.05.1987 № 4286-87, State Committee of Science and technology of the USSR 05.05.1987*).

In the 1980s the first documents on municipal waste and sanitary maintenance of urban areas were developed and enforced:

- *The order of Health Ministry of the USSR from 20.07.1983 № 858 "On enforcement of the rules on sanitary protection of the territory of the USSR"*;

- *Sanitary Regulations on maintenance of settlements. SanPiN 42-128-4690-88 (Appr. Ministry of Health of the USSR 05.08.1988 № 4690-88*).

In the end of Soviet era the Government realized that environmental policy should be changed, the economic instruments for nature protection should be improved or established, and the main principle "the polluter pays" should be implemented. As a result the list of documents was approved:

- *Resolution of the Supreme Council of the USSR from 03.07.1985 "On compliance with the requirements of legislation on nature protection and rational use of natural resources"*;
- *Resolution of the Central Committee of Communist Party of Soviet Union and Council of Ministers from 07.01.1988 № 32 "About radical restructuring of the nature protection in the country"*;
- *Resolution of the Supreme Council of the USSR from 27.11.1989 "On urgent measures of ecological rehabilitation of the country"*.

The resolution № 32 *"About radical restructuring of the nature protection in the country"* stated (1) consolidation of state control of the management of natural resources and environmental protection through the organization of the USSR State Committee for Nature Protection; (2) the improvement of the economic mechanism ensured efficient use and conservation of natural resources (primarily through payment for use and pollution of natural resources); (3) the solution on the development of the USSR Law on environment protection.

Before the USSR collapse the system of environmental legislation did not include the laws on WM, the regulations were insufficient due to underdevelopment of economic instruments and weak enforcement. At the same time the system of collection and utilization of SRM was strong and had well-developed legislation (laws, rules and technical standards).

The state policy in the recycling provided high increase of economical use of SRM. In the most cases the use of waste as SRM was increasing much faster, than the waste generation. Special State Program established increasing the use of recycled materials by more than twice from 1986 to 2000. According to the integrated program of the scientific and technological development of the USSR, by the 2000 the level of treatment of the main large-tonnage waste had to reach 100 % for some types of waste (ferrous and non-ferrous metal wastes, used petrochemical products, sulfur wastes, slag of ferrous and non-ferrous industry, lignin, waste paper, textile, polymer, leather and wood). The level of MSW treatment should be achieved 35-50 % (Devyatkin, 2007). It was planned to carry out wide-ranging R&D and to put the necessary production facilities into operation by the branch ministries.

Soviet republics developed their own normative regulations, which, in fact, duplicated all-union documents, or used all-union regulations directly, or used normative regulations developed by other Soviet republics.

The regulations in the field of MSW management were developed by MHPU; regulations were supervised by the sanitary-and-epidemiologic service and were not referred to the environment protection sector. Recyclables were not considered as municipal waste, and its collection and treatment was regulated by others set of documents.

1.2.3 Development of waste management situation and infrastructure

Data and its availability

At present, the data on the MSW management system in the BSSR is practically not saved. The official representatives of statistics agencies say that almost all reports were sent to Moscow and were not kept in Belarus. The enterprise documentation was handled in the archive and it is too hard to become familiar with it. In the course of political transformations a lot of documents were lost. It should be mentioned that the soviet statistics did not collect in-depth information on MSW management, and this field was given insignificant consideration.

General scheme of municipal waste management

Municipal waste was divided into solid and liquid ones. The solid waste included the waste of the human life activities, the waste of current apartment repairs, waste of local heating system, waste from yard territories and bulky waste, as well as waste of cultural, housing, health care and others public facilities. The liquid waste included sewage (feces, slops) collected in the buildings without sewerage system.

MSW management was carried out in accordance with the “plan-regular system of collection and removal of municipal waste” which included:

- preparing the waste to loading into waste collector vehicles;
- organizing temporary storage of the waste in households;
- treatment and utilization of the municipal waste.

In general, mixed waste was collected. Organic waste and recyclables (glass, paper and cardboard, ferrous and non-ferrous metals) were collected separately. Recyclables were not “waste”, they were calculated separately from MSW. Most of waste was transported to landfills, and only insignificant part of it was treated (composting or burning).

Some part of industrial waste was transported to municipal landfill too. Industrial plants with waste of III and IV dangerous class could receive permission on removal and landfilling industrial waste at municipal dump. This permission was given by the local sanitary-and-epidemiologic services and the fire preventing inspections. The issue of the quantity of industrial waste accepted at the landfill was decided by the municipal HPU on the basis of local conditions (availability of territory for storing, provision of

machinery). The general quantity of incoming industrial waste had not to exceed 30 % of the daily income of all waste.

MSW generation

Data on MSW generation in cities of BSSR and area of landfills are provided in the Tab. 1.2.2.

Tab. 1.2.2: MSW generation in the cities of BSSR*

Indicator	1977	1980	1985	1990
Urban population, ths per	5012	5362	6077	6762
Amount of MSW, ths t per cap	1071	1219	1488	2358
Area of landfills for MSW, ha	450	460	600	800

* - based on statistic reports

Waste composition

The study of the morphological composition of the MSW was carried out by a few waste treatment facilities with the aim to develop technologies for treatment and disposal. Morphological and chemical composition of MSW is provided in Tab. 1.2.3 and 1.2.4 respectively.

Tab. 1.2.3: Morphological composition of MSW*

Component	Composition, % of the mass
Paper, cardboard	25-30
Food wastes	30-38
Wood	1,5-3
Ferrous metal	2-3,5
Non-ferrous metal	0,2-0,3
Textile	4-7
Bones	0,5-2
Glass	5-8
Leather, rubber	2-4
Stones	1-3
Plastic	2-5
The rest	1-2
Siftings (less than 15 mm)	7-13

* (Sanitary cleaning..., 1990)

Tab. 1.2.4: Chemical composition of MSW*

Component	% of dry mass
Organic matter	56-72
Ash content	28-44

Total nitrogen	0,9-1,9
Calcium	2-3
Carbon	30-35
Phosphor	0,5-0,8
Total potassium	0,5-1
Sulfur	0,2-0,3
Medium reaction, pH	5-6,5
Humidity, % of total mass	40-50

* (Sanitary cleaning..., 1990)

Waste collection and transportation

The organization of “plan-regular system” and regime of removing of municipal waste were established by Resolutions of City executive committees on the proposal of the HPU plants and sanitary-and-epidemiologic services. Frequency of MSW removing was depended on season, climate, and epidemiologic situation. The regime of removal was discussed with the local sanitary-and-epidemiologic services and approved by Resolution of City executive committee.

As a rule, the next terms of the municipal wastes removal were set up:

- from the household territories - once every three days;
- from the household territories with a special regime – every day.

Collection and removal of municipal waste in the cities were carried out by special automobile enterprises (SAE) (as a rule, the only in the city; they combined functions of collection, transportation and treatment; SAEs had state ownership) in accordance with approved schedules and outlines. Construction waste was transported by construction companies to "specially appointed plots".

The area of responsibility of SAE included services on removal and landfilling in residential housing, retails, catering, cinemas, sewing workshops, hospitals, hotels, campuses, kindergartens, schools and other educational institutions, theatres and markets. Sometimes, SAE could serve departmental housing stock and industrial enterprises with local subordination.

The main approach to collect and remove MSW were:

- container system (the system of "replaceable" containers);
- the system of irremovable containers.

In accordance with container system, the waste was removed with containers, and new empty containers were put on their places. In accordance with irremovable system the waste was put directly into special cars and after that the containers were put on their places. In improved housing areas the container system and irremovable system could be used simultaneously. In private housing area more often collection and removal of MSW was carried out in specific days, when special cars collected unload waste boxes from residents.

In accordance with the system of replaceable containers the container capacity was 0,75 m^3; and cars by model M-30A were used. In accordance with the system of "irremovable" containers the container capacity was 0,75, 0,6 and 0,55 m^3 or 0,3 m^3 (for roll-in-containers). The removal of waste was made by cars of different models.

In large cities separate collection of food waste was organized, in some cases collection of bulky waste was carried out.

Bulky waste was defined as waste due to its size can not put in standard container with capacity 0,75 m^3. According to data (Sanitary cleaning..., 1990), about 25 % of bulky waste was ordinary municipal waste with linear size less than 250 mm which by some reasons went into container for bulky waste. For collection and removal of bulky waste special cars were produced with displaceable storage hoppers and capacity 5,5-12 m^3. These containers were installed at special sites in housing area. Removal of bulky waste could be carried out by according to schedule as well as according to claims of the residents. The burning of bulky waste was strictly prohibited at housing area.

Norm of food waste generation was 30 kg/person per year. Organization of collecting food waste was started from allocation of special home boxes (with capacity 10 l or 20-25 l). Boxes with capacity 10 l was used in low-story housing area or in the case door-to-door system of waste removal. In multi-story housing area boxes with capacity 20-25 l were used. Boxes for food waste were bought and repaired by bureau for harvesting of un-planned feed at the expense of pig fattening farm (these expenses were included into the cost of collection of 1 ton of food waste).

The food waste removal from houses could be organized in three ways:

- the food waste was delivered by the collect workers into the yard litter boxes;
- the food waste was thrown out by the tenants into the yard litter boxes;
- the food waste was thrown out by the tenants directly into the vehicle according to the door-to-door waste collection and removal system.

Collected food waste was transported to fattening farms where it was heat-treated (boiling, drying) and also cleaned from the worthless stuff and after that was fed by the kettle.

Treatment

There were 9 WTP in the USSR. 20 facilities were under construction in 1990, but it is unknown whether they were launched. WTP used technology of aerobic biometric composting. Characteristics of the 9 exactly working facilities are given in the Tab. 1.2.5.

Tab. 1.2.5: The operating data of waste treatment facilities working in the USSR*

Indicator	Leningrad	Moscow	Tashkent	Minsk	Alma-Ata	Baku	Tbilisi	Mogilev	Gorky
Startup year	1971	1972	1977	1978	1981	1983	1984	1974	1987
Capacity, thousand ton per year	200	110	80	80	65	65	40	34	40
Compost and biofuel output, thousand ton per year	140	35	50	60	40	40	30	20	22
Ferrous metal output, ton per year	3000	1600	1500	1500	1000	1000	1000	500	600
Processing cycle time	2	4	2	2	2	2	2	2	2
Occupied area, ha	8	6	5,9	4,5	5,8	6	5	4,5	5,7

* (Sanitary cleaning..., 1990)

As follows from the Tab. 1.2.5, in the Soviet time there were 2 plants producing biohumus which with varying success are still existing in Belarus; as well as 3 plants were located in Russia, and 1 in each republic in Kazakhstan, Uzbekistan, Azerbaijan and Georgia.

Landfilling

Landfilling of MSW was the main method of waste "treatment". It was distinguished 2 types of landfills: organized and unorganized (illegal in modern terminology) which were located near every settlement. For a long time, landfills had no environmental requirements to their design, and the first environmental standard for the design of landfill had very short list of such requirements. In practice, many of these requirements were not met. Number of landfills, the amount of accumulated waste was not taken care by HPU or environmental agencies. The subject of statistic reporting was amount of removed waste (municipal and industrial). Control and monitoring of removed waste was carried out by treatment and disposal facilities (landfills, treatment plants, incineration plants and etc.). Control and calculations should be done based on actual measuring, but at the same time many landfills were not equipped by weights, that why amount of removed waste was written down based on theoretical calculations of “norms of waste generation”. Formally, city department of HPU approved annually and took to the landfill the list of serviced industrial enterprises with identification of waste types and allowed amount for landfilling. Laboratories at the landfills should check and make random monitoring of delivered industrial waste once a quarter from each company. At the same time, most of landfills did not have laboratories, so control and monitoring was not carried out at all.

Data on area of landfills is shown in Tab. 1.2.2. There is no available data on number of landfills and amount of collected and stored waste in BSSR.

Recycling

Until 1990, in the USSR there was system of “Gossnab”, which was in charge for collection, calculation and use of recyclables. It was strong belief that the use of recycled materials is a powerful factor of resource saving. The special institute of recycling materials was established to provide effective scientific and engineering assistance for resource saving approaches and use of SRM.

Recyclables were collected by 4 departments (Glavk):

- Glavvtorsyr’e (Ministry of light industry) – collection of recyclables in cities and working settlements;
- Tsentrosoyuz – collection of recyclables in rural areas;
- Glavvtorchermet (Ministry of Ferrous Metallurgy) – collection of recyclables at industrial enterprises and farms;
- Glavtsvetmet (Ministry of non-ferrous Metallurgy) – collection of recyclables at industrial enterprises and farms.

It was established quite powerful special industrial infrastructure for the collection and industrial treatment of the main types of secondary raw materials over the whole area of the USSR.

Only the system "Soyuzvtorglavresursy" of Gossnab in the 1980s included (Devyatkin, 2007) 527 enterprises of SRM and 5677 collecting points for recyclables from the population:

- Enterprises for treatment of waste paper - 4;
- Enterprises for treatment of textile - 80;
- Enterprises for treatment of polymers - 8;
- Production and harvesting plant, and harvesting and manufacturing bureaus - 471 of them with functions of treatment - 32;
- Collecting points - 5 677 of them are stationary - 3793, mobile - 1884.

The collection, treatment and recycling of SRM in the cities and towns was carried out by about 40 ths specialists of the “Gossnab” (Zakharov et al., 1980). The level of waste paper collection in the system was around 59 %, textile – 51 %, bones – 43 % of used tires – 31 % (all figures are given in relation to the urban population by the end of 1978) (Zakharov et al., 1980).

Collection of recyclables from residents was organized through the usual collecting points, combination of collecting points and shops (points-shops) and HPU sites (Zalkind et al., 1985). The most common form was points-shops. They exchanged collected recyclables on consumer goods. In 1979 there were 1092 points-shops in the system of “Gossnab” (Zakharov et al., 1980). Positive aspects of the organization of the points-shops were: (1) increasing amount of collected recyclables; (2) significant improving the quality of collected recyclables; (3) relative reduction in the number of employees per unit of collected recyclables; (4) engaging high qualified staff;

(5) improving service culture; (6) educational impact on population. It was fixed significant growth of collected paper and cardboard from residents since the starting of points-shops (October 1974). During next 5 years additional 800 ths t of waste paper was collected (Zakharov et al., 1980). The average amount of collected recyclables in points-shops was in 2 times more than in the usual collecting points. However, this method did not give a significant growth of total collection of recyclables and led to redistribution of resources in the places of their generation. Mobile collecting points allowed to collect in 2-3 times more recycled materials than stationary (Recycling materials, 2015).

Collection of recyclables through HPU sites was based on the agreement between HPU sites and Production and harvesting plants. Collected recyclables at HPU sites were characterized by: (1) higher cost for collection (about 17 %); (2) lower quality. Collection of recyclables at HPU sites was carried out by yardmen or by special staff or by brigadier method. The brigade served part of the housing area. Collected recyclables were stored in special room. On the request of the brigade recyclables were transported to Production and harvesting plants.

In the former USSR it was collected about 90 % of glass, on which there was a collateral price. Points for glass collection were placed everywhere, and at the any store you could buy goods without cost of glass (if you have glass for exchange, of course).

There is no available data on amount of collected recyclables, and their use in BSSR.

1.2.4 Legal and economic instruments to support waste management hierarchy

The high level of the cost for collection and treatment of "unprofitable" waste (industrial and consumption) was compensated by including these costs in the cost of production of relevant industries.

There was effectively working system of collateral prices for glass.

To increase amount of collected recyclables from the population, different incentive mechanisms were used:

- Sale of stimulus (eg, “scarce”) goods in exchange for recyclables. The outcomes of the collecting points for the 1977-1979 shown that the national average for the purchase of 1 ton of waste textile was 150-180 rubles. For increasing public interest it was provided special exchange rate, depending on the amount of recyclables. So, if for the purchase of goods with price up to 50 kop. you should collected recyclables for the same amount; for goods up to 3 rubles you needed to collect recyclables on 1,5 rubles and so on (Zakharov et al., 1980).

- Collection of waste paper in exchange for imaginative literature. The experiment began in 1974. Over the next 10 years was published 117 titles with a total circulation of more than 130 million copies and collected 2,6 mln t of waste paper. In average, per 1

ton of waste paper has been issued 50 books and was paid 20 rubles, which demonstrates the high economic efficiency of the action. This form of waste paper collection covered 48 million people in 60 Soviet cities (Zalkind et al., 1985).

- Bonuses and payments for participants of actions on waste paper and scrap metals collection, which was regulated by specific governmental resolutions. It was spent more than 4 mln. rub. annually (1980) for payments on collected waste paper by students and schoolchildren and for awarding the winners of the all-union competition (Zakharov et al., 1980).

There is no available data for BSSR on regional instruments for support waste management hierarchy.

1.2.5 Waste management system financing

Soviet Union is an example of a centralized and planned economy that directly concerns all spheres of economic activities including MSW management and recycling. In 1969 the planned pricing in the USSR has been became a separate area of governance. State Committee of prices of Council of Ministers in the USSR was established. State Committee of prices was in charge for pricing policy, for organization and operation status of prices in the USSR, as well as for the validity of the approved prices and tariffs.

The financing system was operated by follow way. State established tariffs for the removal and treatment of municipal waste for all settlements in the country. Cross-subsidization was widely spread approach in municipal services. Tariffs for the population were much less than for legal entities. Tariffs for the population did not cover all costs of municipal services; the difference was subsidized from the state budget or at the expenses of legal entities. Tariffs for the population were maintained unchanged for the long time at the minimal level throughout the Soviet period.

All investments came from state budget, there was no private business.

There is no available data on tariffs for the population end legal entities used in BSSR.

1.2.6 Public awareness, education and communication initiatives

The social motivation of the population was the base for the SRM collection in the USSR. On the one hand cultural behavioral patterns were formed; on the other hand, the importance of the recycling was promoted (Recycling materials, 2015).

Mentioned above action “Imaginative literature in exchange on waste paper” had impressive effect on Soviet people. In addition to this action special interventions were carried out for involving youth in recyclables collection. Since 1974 and until the USSR collapse all-Union competition for Young Pioneer and Komsomol organizations on

collection of paper was held. The motto of action was "Million to Motherland!" Action had significant educational value (Zakharov et al., 1980). After the starting of all-Union competition paper collection by schoolchildren increased by more than 2 times (before competition annually collected 80-95 ths t, during competition – 177-197 ths t) and achieved 8-9 % from total paper collection in the USSR (Zalkind et al., 1985).

Huge attention was given to the reporting about all-Union competition and promotion of the waste paper collection. Mass-media was involved into distribution of information: newspaper "Komsomolsky projector"; the broadcast "Pionersky signal" and etc. In addition, excursions to the paper plants and print shops for schoolchildren were organized; residents were informed through performances before the parents in the school, conversations of the schoolchildren with tenants and so on.

1.2.7 Barriers and success factors for waste management performance

In regards to the Soviet system of MSW management the following strengths and weaknesses (Tab. 1.2.6) can be identified.

Tab. 1.2.6: Strengths and weakness of Soviet WM system

Strengths	*Weakness*
Propaganda, powerful information support of governmental decisions	Lack of an attention to the problem of waste, the lack of sound policy in this area
Trust and support of government by the public	Lack of environmental legislation
Huge resource, research and development, production and technical, administrative capacity	Institutional fragmentation and overlapping of powers
Huge area with different conditions	The rigid centralized and planned economy, the absence / lack of foreign investment, the lack of private business

1.3 DEVELOPMENT OF WASTE MANAGEMENT SITUATION IN BELARUS AFTER 1990

1.3.1 Legal and institutional framework of waste management

After 1991 Belarus started to develop own system of environmental legislation. Belarusian environmental legislation has two main features:

- Differentiation of legislation and approving the special codes and laws for specific natural resources, for example, Forest code, Land code, Law on fauna protection and etc.;

- Integration of legislation and approving integrated laws, for example, Law on environment protection, Law on state environmental expertise, Law on waste management and etc.

Current system of environmental legislation on WM in Belarus includes follow levels and types of legislative documents (Tab. 1.3.1).

Tab. 1.3.1: WM legislation in Belarus

Legislative document(s)	***Main statements on waste management***
Constitution	States (1) the right on healthy environment (art. 46) and (2) the duty of every citizen to protect the environment (art. 55)
Law On environmental protection (1992)	Law was adopted in 1992. In 2002 the Law was radically revised and reworded. After 2002 the Law was revised in 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2013 and 2014, i.e. almost every year. The law establishes (1) the principles of sustainable use of natural resources, (2) the legal content of general and special natural resources, (3) content of rights and obligations of citizens, public associations, enterprises and organizations in the implementation of environmental policy, (4) general requirements for the protection of the environment, taking into account the specific of various human activities, (5) the value and the content of the economic mechanism in the field of environmental protection, etc. In regards to WM the Law establishes (1) the powers of local executive and administrative bodies in the field of WM: they establish the place of waste disposal; organize collection, transport, storage and disposal of municipal waste generated at their territory (art. 11); (2) requirements for environmental protection during the production, handling and disinfect of hazardous chemicals (art. 46); (3) requirements for environmental protection in the process of WM (art. 50).
The law On waste management (**1993** – first version; **2007** – the last version)	The special law on Waste management was adopted in 1993. The law (1) established the legal basis of WM and (2) has aim to prevent the harmful impact of waste on the environment and human health, to ensure and protect the rights and legitimate interests of persons linked to the WM, as well as (3) to increase the involvement of waste into economic circulation as SRM. The law establishes power of different agencies in the sphere of WM and property rights on the waste; gives definitions and classification of waste, describes principles of WM. There are special statements about the obligations of municipalities to manage solid waste and about their duty to work out the scheme of MSW management. Also the Law has laid the mechanism for the EPR. The maintenance of landfills is also the point of the Law. The law has special chapter on WM, which includes obligations of legal and natural persons; requirements on WM of industrial waste, MSW, goods lost the consumer properties; requirements to WM during an implementation of various activities, requirements to collection, separation, storing and transportation, recycling and utilization of the waste. In 2007 the law was revised. There were: - Changed principles of WM. Were included priority of utilization under landfilling, the obligatory procedure of the establishment of toxic class, and access to data; - Added additional responsibilities of different actors; - Added article on the development of territorial programs on

	WM; - Added requirement of obligatory construction of facilities for extraction of SRM from the waste transported to landfill; - Added requirement of obligatory construction of facilities for environment protection.
Decrees / Directives of President	President's Decrees / Directives link to regulations of collection of different types of waste, license of activities in the sphere of WM.
Resolutions / orders of Council of Ministers, ministries and state agencies	Long list of different documents were adopted by state authorities. They establish norms and rules of practical implementation WM policy. Some of them will be describe below.
Programs and strategies	Programs and strategies are adopted by special resolutions of Ministries and Council of Ministers. They have aim to implement specific interventions for improving WM. Under resolution of President in the beginning of 2016 the development and implementation of programs and strategies were stopped due to economic crises.
Resolutions of local authorities	Documents are adopted at the local level according to power of authority in the sphere of WM.
Instructions, rules, norms and technical standards and etc.	Documents are adopted by ministries, agencies and Council of ministers. They are mandatory for all legal and natural persons.

Belarus was the first post-Soviet Union country which established the ban to landfill SRM as well as the implementation of the principle EPR. Belarusian legislation regulates the different types of waste (Tab. 1.3.2).

Tab. 1.3.2: Belarusian regulations for different types of waste

Type of waste	***Legislative documents***
Municipal solid waste	In regard to management of MSW were adopted: - ***Nomenclature of MSW*** *(National Register of Legal Acts of Republic of Belarus, 2001, № 119, 8/7531*); - ***Rules for estimations of MSW norms****, Resolution of MHPU and MNREP from 27.06.2003 № 18/27*; - ***Instruction on the development of schemes for WM of MSW****, Resolution of MHPU № 19 from 17.04.2009*; Instruction established the procedure of the development, matching and adopting schemes of WM in settlements of Belarus. Schemes are developed and adopted by local executive power under matching with territorial offices of MNREP and Ministry of health care. - ***Instruction on the organization of selective collection, storing and transportation****, Resolution of MHPU from 30.07.2003 № 26*; The instruction established the rule: owner of solid waste must collect waste separately depends on their types and store them in special containers as well as must to exclude the displacement of harmful substances to waste. There is no instrument in hand how to implement the mentioned above rule. - ***Technical standard on WM and operating rules for disposal facilities*** *(TCP 17.11-03-2009*); Standard is applied in the case (1) location, design, construction, reconstruction, operating, destroying the disposal facilities of solid waste; (2) EIA, (3) environmental control and monitoring. - ***Sanitary rules on maintenance of settlements****, Resolution of Ministry of Health care from 01.11.2011, № 110*; - ***Requirements for the location and operation of the facilities***

	***carrying out the sorting and processing of municipal waste**, Resolution of MNREP and MHPU from 20.12.2004 № 38/37*.
Hazardous waste (in general)	Documents link to hazardous waste transactions (*Resolution of Council of ministers from 17.01.2008 № 61 and from 23.10.2009 № 1391 with additions from 08.10.2015, № 842*).
Mercury and mercury-containing waste	The list of documents in according to mercury includes: - ***Regulations on the procedure of accounting, storing and collection of mercury and mercury-containing waste**, Resolution of Ministry of Economy, MNREP and Ministry of Health care from 31.07.1998*; - ***Sanitary rules at work with mercury**, SanRaN 9-109 RB 98 and Resolution of Ministry of Health care from 12.04.2013 № 30*; - ***Technical standards on waste management rules after demercurization** (TCP 17.11-04-2011) **and containers for mercury-containing waste** (STB 2168-2011)*
Lead storage batteries with electrolyte	Document established the procedure of collection and storing of waste (*Resolution of Council of ministers from 09.03.2007 №297*).
Automobile exhaust converters	Document established the procedure of collection of waste (*Letter of Ministry of finances from 20.11.2007 № 17-1-25/2107*)
Polychlorinated biphenyls	Document established the procedure of WM for waste (*Resolution of MNREP from 24.06.2008 № 62 and Resolution of Ministry of Industry from 21.05.2007*)
SRM (in general)	Documents regulate: - coordination of activities in the sphere of SRM management (*Resolution of Council of ministers from 31.07.2012 № 708*); - creation the Operator of recyclables (*Resolution of MHPU from 21.09.2015 № 26*); - hygiene requirements for the collection, storage, transport and primary processing of secondary raw materials (*SanRaN 2.1.12-61-2005*); - report form (*Resolution of ministry of statistic and analysis from 03.10.2008 № 230 with additions from 06.11.2009*)
Glass, paper, cardboard, packaging	Documents regulate: - WM of glass (*Resolution of Council of ministers from* 06.07.2009 № 896), WM of paper and cardboard (*Resolution of Council of ministers from 09.01.2009 № 16*); - The procedure of collecting and payment for glass (*Resolution of MT from 20.02.2004 № 8*), paper (*Resolution of MT from 24.02.2009 № 12*), packaging (*Resolution of MNREP from 28.08.2012 № 39 with additions from 2014*); - The assessment of the reports reliability (*Resolution of Ministry of statistic and analysis from 18.09.2015 № 24*)
Scrap and waste of ferrous and nonferrous metals	Documents established: - involving waste in economy (*Resolution of MI from 16.09.2004 № 10*); - registration, storage, use and sale of waste (*Resolution of Ministry of Economy, Ministry of architecture and construction, MI from 15.06.2006 № 98/12/10*); - report form (*Resolution of MI from 11.01.2007 № 2, Resolution of Ministry of statistic and analysis from 01.07.2013 № 57*)
Wood waste	It is adopted regulations on use of waste (*Resolution of MNREP from 06.07.1999*)
Waste of hydrocarbons and petroleum products	Technical standards established rules of use of hydrocarbons waste (*TCP 17.11-01-2009*) and the use of petroleum products waste (*TCP 17.11-05-2012*)
Goods lost their consumer properties, package	Legislative documents have aim to establish the procedures for WM of waste: - the list of producers who have responsibilities to collect and return goods lost their consumer properties (*Resolution of*

	Council of ministers from 21.12.2007 № 1789,Resolution of Council of ministers from 02.12.2014 № 1123); - the procedure of waste collection (*Resolution of Council of ministers from 02.12.2014 № 1124, Resolution of MNREP from 02.12.2014 № 1123)*; - report form and accountability (*Resolution of MHPU from 18.03.2015 № 6*)
Industrial waste	Industrial waste has a long list of different regulations. Some of them established: - the order of the identification of hazard level of industrial waste (*Resolution of MNREP, Ministry of health care, MES from 17.01.2008 № 3/13/2 with additions from 20.12.2011 № 51/125/67*); - inventory order of industrial waste (*Resolution of MNREP from 29.02.2008 № 17 with additions from 15.12.2011 № 49,* and the procedure of waste norms development *(Resolution of MNREP from 22.11.2007 № 89*); - the order of development and adopting instruction on WM of industrial waste *(Resolution of MNREP from 22.10.2010 № 45 with additions from 01.10.2012 № 44*); - report form and accountability (*Resolution of Ministry of statistic from 19.09.2013, № 208*)

Belarusian legislation on WM includes also regulations on:

- terms and definitions (*GOST 30772-2001*), classifier of waste (*Resolution of MNREP from 8.11.2007 № 85*), classification of waste (*GOST 30775-2001*); waste cadaster (*Resolution of Council of ministers from 19.06.2010 № 934*);
- report forms and accountability (*Resolutions of MNREP from 02.06.2009 № 33, 9.12.2008 № 112, 22.10.2010 № 44 and etc., TCP (17.02-12-2014*);
- methodological approach to calculating damage as a result of illegal landfilling;
- landfills – ecological passport (*Order of MNREP from 08.02.1996, № 19*), technical regulations on development and maintenance of facilities (*SanPIN 2.1.7.12-9-2006, Order of MNREP from 19.01.2000, № 14/8a*), the procedure of registration of facilities (*Resolution of MNREP from 10.12.2007 № 99 with additions from 30.06.2009 №47*).

It is evident, that Belarus has well developed legislation in the field of WM in particular if we take into account fact, that after the USSR collapse Belarus had to start from “zero” level. However, it should be noted that the legislation is needed in improving.

Firstly, we should say about confusion in definitions of solid municipal waste and municipal waste in Belarusian legislation. Removal and treatment of municipal waste is an area of responsibility not only waste producers, but local authorities. It is a main reason of distinguishing special type of waste – municipal waste (Gnedov, 2012). Definition of municipal waste is established by special Resolution of MHPU (Nomenclature of MSW). Brief look at this Resolution allows concluding that there is no a list of municipal waste types, but list of types of activities and places of waste generation. According to this Resolution, local authorities are in charge for all waste generated by population. On the other hand, there is a special position in the Classifier

of waste – “waste from vital functions of population” (Classifier of waste). It means, that “waste from vital functions of population” is only small part of waste generated by population (because it generated PET-bottles (other waste type with code 5711400) or waste paper (code 1870605) and so on). In the result, local authorities are responsible for removal and disposal only part of waste, not all waste generated by citizens. The regulations on tariffs are used the term “solid municipal waste”, at the same time such position is missed in Classifier of waste.

There is confusion in distinguishing terms of removal and treatment of MSW. In fact, “MSW treatment” according to legislation on HPU is understood as “MSW landfilling”. It is no clear definition of term “MSW removal”. It is not explanations where and for what removal is carried out. In practice “removal” means transportation of waste from places of temporary storage to landfill by special transport. As we see, under Belarusian legislation and established everyday practice, MSW – is a part of consumption waste, transported to landfills; MSW doesn’t mean type of waste, but common word to name waste generated by residents, the term “removal and treatment of MSW” means “transportation and landfilling of MSW”.

Main document on MSW management is Instruction № 26. According to art.7 of Instruction № 26 local authorities must: provide separate collection of MSW, make a decision on organization of separate collection of MSW, and create conditions stimulating recycling. At the same time, instruments and mechanisms are not established. Instruction № 26 provides requirements to temporary storage of MSW (art. 8) and rules for containers allocation (art. 9). These articles contradict each other.

Art. 19 of Instruction № 26 establishes criteria for landfilling MSW: waste could be landfilled if it has a share of recyclable 5 % and less. At the same time there is no procedure how to monitor or control this criteria and what should be done, if the share of recyclable more than 5 %.

There is no special definition of WEEE in Belarusian legislation; there are no special regulations for this type of waste. WEEE consists of ferrous and non-ferrous metals, plastic, precious metals, glass, rubber, and other fractions. Therefore, WEEE treatment is regulated by various groups of legislative documents: general legislation on WM, legislation on precious metals turnover, legislation on ferrous and non-ferrous metals recycling (Gnedov, 2012).

There is no clear definition of bulky waste. This type of waste is mentioned in Instruction № 26 and Sanitary rules on maintenance of settlements, but due to unclear definition and lack of statistic accountability bulky waste is not collected and fixed in reports.

It should be mentioned, that HPU statistics uses data in m^3, but recyclables fixes in tons. That why it is quite complicate to compare data. Usually for recalculating m^3 in tons is used factor 0,2. As a result, the inaccuracy of figures increases.

Current legislation and established practice suppose that only organization is in charge for removal and disposal of MSW in settlement. There is no distinguishing of

mentioned functions, but it could be helpful to make it for attracting private companies to sector and improving MSW management (Survey..., 2016).

In spite the fact, that Belarus was one of the first post-Soviet countries established principle of EPR, there is a lack of regulations in this field. Instruments for practical implementation of principle were started to develop in last 3 years, they have a lot of gaps and mismatches.

Regulations, laws and norms are implemented through programs and strategies on improving the WM in Belarus. During last 25 years were implemented 7 programs on WM:

- ***Program of environmentally and economically sound management of waste**, Resolution of Council of ministers from 02.09.1994 № 39*;

- ***Concept. Disposal, processing and recycling of municipal solid waste (MSW) in the case of Belarus**, Order of MHPU from 05.09.1996 № 105*. Concept was included review and analysis of methods and approaches to WM of MSW, its disposal, processing and utilization;

- ***Republic program on WM of MSW**, Resolution of Council of ministers from 01.09.1998 № 1368*. Program established practical interventions for sanitary cleaning of large and big cities and regions in the whole, as well as organizational, technical, economic and legislative measures for improving WM of MSW. The list of program indicators includes:

  - number of special transport and container equipment (increasing from 63 % in 1997 to 100 % in 2005);
  - level of separate collection of MSW (increasing from 0,1 % in 1997 to 50 % in 2005);
  - level of utilization of SRM (increasing from 0,4 ths t in 1997 to 830 ths t in 2005);
  - disposal of waste (1) on unequipped landfills (decreasing from 62 % in 1997 to 0 % in 2005); (2) on landfills (decreasing from 33 % in 1997 to 17 % in 2005), (3) on sorting stations (increasing from 0 % in 1997 to 26 % in 2005); on industrial enterprises (increasing from 5 % in 1997 to 4 % in 2005).

Due to different reasons, the program indicators were not achieved.

- ***National plan on rational use of natural resources and nature protection of Belarus on 2001-2005**, Resolution of Council of ministers from 21.06.2001, № 912*. Objectives of the plan in the sphere of WM are:

  - improving the legislation on WM;
  - development and implementation of environmental friendly and law-waste technologies;
  - development of methods, technologies and way of disposal of hazardous waste and their use as raw materials.

- ***Sectoral programme on WM of MSW on 2007-2010****, Order of MHPU from 10.08.2007, № 153*. The overall objective of the program is to prevent adverse environmental impacts associated with municipal and hazardous waste. Specific objectives in these two areas are: (i) to ensure coverage in 100 % of population in large cities by separate municipal waste collection, and to maximize the recovery of valuable materials; and (ii) effective management of high priority chemical pollutants, specifically POPs. The list of indicators stated achieving in the end of 2010 next figures:

- number of special transport and container equipment – 100 %;
- level of separate collection of MSW – 100 %;
- level of separation and utilization of MSW – 14 %;
- amount of collection of SRM – 280 ths t;
- coverage of sanitary cleaning of rural settlements – 100 %.

The most indicators were not achieved to 2010.

- ***State program on construction of protection facilities at the existing landfills for preventing environment pollution by waste, products their interaction and (or) decomposition on 2008-2014****, Resolution of Council of ministers from 05.03.2008 № 333*;

- ***State program of collection (provision) and utilization of secondary materials in Belarus on 2009-2015****, Order of President of Belarus № 327*. The programme states the main directions of work, priority actions in collecting waste and its use as SRM as well as prevention of the environmental pollution through waste management issues. The Programme provides the basis for improvement of the regulations, SRM management, waste prevention and increasing of their use as recycled materials, stimulation of collecting and use of SRM, carrying out measures for increasing of public awareness. Nowadays the scheme for MSW management is under consideration;

- ***Concept of WM of MSW and recyclables in Belarus on 2014-2020****, Order of MHPU from 07.07.2014 №78*. Main objectives of the Concept are:

- analysis of best practices in the sphere of WM of MSW and extraction of SRM;
- assessment of current state of WM of MSW and recycling in Belarus;
- establishing measures of effective WM of MSW.

Indicators of the Concept implementation:

1. Extension of the range of SRM from the MSW.

2. Sorting and recycling of not less than 1 mln t /yr of MSW.

3. Providing collection of not less than 815 ths t of SRM across the republic by the end of year 2020.

4. Proving the break-even work of HPU for the population according to cycle of MSW management (collection, removal, sorting, recycling, decontamination, disposal).

5. Attraction of private investment in the sphere of removal, recycling and treatment of municipal waste for the individuals and legal entities.

6. The achievement of the fixed rates in accordance with the President Decree from July 11, 2012 № 313 "On some issues of the treatment of municipal waste."

According to the Strategy of the Collegium of the MNREP (№ 8-r from 28.01.2010) in the field of the environmental protection for the period until 2025, the following tasks were set:

- providing 100 % coverage of separate collection of MSW for the population;

- setting up the system of collection, using and (or) decontamination of the population household appliances and other goods lost their consumer properties, including waste with hazardous substances, for the period until 2016;

- providing full, regular and planed removal of domestic waste for urban and rural population;

- improving the system of separate MSW collection considering the extraction of at least 70 % of SRM of the total waste generation;

- construction of waste recycling plants in Minsk, regional centers and cities with population over 100 thousand people by 2016, cities with population over 70 thousand people – by 2025;

- construction of facilities that using combustible fractions of waste as a fuel to produce electricity and heat, as well as facilities for composting of organic component of MSW in the city of Minsk, regional centers and cities with population over 100 thousand people by 2016, cities with populations over 70 thousand people – by 2025;

- extraction of landfill gas at the municipal landfills considering an economic efficiency;

- setting up collection, use and (or) treatment of goods lost their consumer properties and containing hazardous substances by 2012.

At present, the interventions of program, for example, construction of recycling plants or composting of organic waste postponed indefinitely due to economic crises.

Territorial waste management programs are developed by local executive and administrative bodies and approved by the local Councils of deputies. Territorial waste management programs are divided into regional (Minsk City and Oblast' programs) and district (municipal) programs. The duration of the waste management programs is 5 years usually. Territorial waste management programs include parameters of the collection of SRM and their use. Furthermore, territorial waste management programs include measures to achieve these parameters, measures for the construction of storage facilities, facilities of waste burial and treatment, as well as other measures, which are necessary to reduce the harmful effects of waste on the environment and residents' health and their property.

The functions and competencies of various players in accordance with the current Belarusian legislation are presented in Tab. 1.3.3.

Tab. 1.3.3: Actors‘ power and functions in WM of MSW in Belarus

Level	Sector	Actor / stakeholder group	Power and functions
National	Government	President	Establishes national policy on WM and its financial instruments; Establishes procedures for granting governmental support to legal entities and individual entrepreneurs; Approves state programs; Establishes requirements to WM of some kinds of waste
	Government	Council of Ministers	Implements a common state policy; Establishes the procedure for calculation of a sum of pledge, the procedure for making a pledge to the national budget and its return, the procedure and conditions for licensing import and (or) export of waste in Belarus; Establishes the list of hazardous waste, the transfer of which is a subject of registration, and establishes the procedure of the registration of such deals; Approves regulations on state organization – Operator of recyclables.
	Government	MNREP	Implements the state policy, provides the development and execution of state programs on WM; Coordinates the activities of other WM agencies, except of coordination in treatment of recyclables; Approves a waste classifier, procedures of development and establishment of instructions on WM, inventory of industrial waste, its dangerous class, schemes of WM in garden and garage cooperatives, collection, utilization and recycling of consumer waste; Approves the forms of accounting documents, issues permits, licenses; Maintains a register of areas for the use, storage and waste landfilling; Controls WM; Approves technical codes on practical operation and exploitation of areas for landfilling and deactivation of municipal waste.
	Government	MHPU	Implements the state policy, ensures the development and implementation of state programs on WM; Approves the nomenclature of waste, municipal

			waste, a procedure of development, coordination and approval of the municipal WM schemes, approves technical codes on practical operation of areas of landfilling and treatment of municipal waste; Coordinates the activities in the field of recycling.
	Government	Ministry of Health care	Provides the state policy, ensures the development and implementation of state programs on WM; Carries out the state sanitary inspection; Provides coordination of the regional programs (Minsk) of WM. Responsible for management of medical waste.
	Government	ME	Responsible for management of radioactive waste.
	Government	MES	Provides the state policy, ensures the development and implementation of state programs on waste management; Provides state supervision over the handling of explosive and flammable waste.
	Government	MT	Responsible for permissions on import / export of hazardous waste
	State agency	Operator of Recyclables	Responsible for implementation of EPR
Regional and local	Self-government	Councils of deputies	Provides the state policy on WM; Approves regional programs on WM.
	Self-government	Executive committees	Develops regional programs on WM and organizes their implementation; Organizes the removal of municipal waste; Develops and approves treatment scheme for municipal waste; Ensures exploitation of municipal landfills; Collects SRM; Organizes the implementation of measures to prevent the harmful impact of waste on the environment and health of citizens, their property; Informs businesses and individuals, including individual entrepreneurs, on WM issues.
	Private and public	Legal entities and individual entrepreneurs	Provides waste collection and its separation by type; Develops and approves an instructions for the handling of waste production and ensures their implementation; Ensures treatment and (or) the use of waste or their transportation to the objects; Keeps records of the waste and carries out their inventory; Submits primary statistics; Develops and adopts measures to reduce the volume (to prevent) of waste generation;
	Public	Companies that provide collection and removal of	Makes conditions for fulfillment of the requirements established by laws; Ensures removal of domestic waste;

		waste, storage and waste disposal	Maintains records of the waste for the storage, treatment and landfilling; Carries out waste storage, treatment and landfilling in accordance with legal requirements; Keeps in good technical conditions equipment and buildings that prevent pollution of the environment by waste and by products of their interaction and (or) their decomposition products.
Local	Public	Public	Obliged to ensure waste collection and separation of their species if the necessary conditions are made.

1.3.2 Development of waste management situation and infrastructure

1.3.2.1 Data and its availability

Information about generation and use of industrial waste is a subject of the state statistical observations made on Form 1- waste (MNREP) "Report on the Treatment of Industrial Waste". The form is submitted by legal entities engaged in activities related to the treatment of industrial waste, except for legal entities which have only waste products similar to “waste from vital functions of population”, with a total volume of such waste not exceeding 50 t / yr. State statistical reporting on Form 1- waste (MNREP) is used in the preparation of statistical compilations, national reports and bulletins on the environment, other regular information publications.

State statistical observations provide data on the number of generated industrial and removed solid municipal waste, i.e. there is no data on the amount of waste generated in households.

MHPU collects information in departmental reporting form 1- sanitary cleaning "Report on Sanitation of settlements". This data includes information on the volume of MSW collected from the public and legal entities and sent to sorting and disposal points, or collected as SRM. This data is collected annually and presented by legal entities engaged in cleaning of settlements and managing municipal waste. Also, this data is submitted to the city or district department of HPU, then – aggregated data - to the RD of HPU, after that SUE "Bel Utilities Proekt” makes a summary report for MHPU.

However, this data is not complete, as it does not reflect the quantity of waste removed by the producers of this waste themselves. National Statistical Committee publishes data on MSW quantity obtained from MHPU in the collected book “Environment Protection in the Republic of Belarus” and uploads it on the website (Towards..., 2014).

Institutional and legal basis for data submission to international organizations: Republic of Belarus is a Party to Basel Convention and has to submit annual report on the implementation of the Convention which includes MSW. Mentioned “**Report on Sanitation of settlements**” includes following list of indicators:

- Municipal waste disposal facilities (data on the number of facilities, installed capacity, free capacity);

- Municipal waste sorting and processing facilities (data on the number of facilities, installed capacity, volume of processed municipal waste, selection of recoverable resources, waste disposed for landfilling);

- Municipal waste collection, removal and disposal (data on the number of population covered with sanitation and cleaning services, municipal waste collection and removal);

- Collection and recovery of recyclables (data on recycling by types of materials).

Belarus managed to populate the data on municipal waste disposal from 1990. The data on the volume of municipal solid wastes processed at sorting lines, waste recycling are monitored in the country based on reporting data from 2011 only.

General scheme of municipal waste management is follow (Fig. 1.3.1).

Almost all municipal waste is collected together (mixed waste) and are transported to the landfills. Waste separately collected in special bins is transported to the sorting stations, the remainder is sent to landfills. SRM in a good condition are collected by the system of consumer cooperatives at the collecting points for recyclables, but the list of such SRM is limited (waste paper, metals, textiles) and the purchase prices do not encourage people to give them away. The redistribution of SRM from the container system to the system of collecting points takes place in case when two systems are working in parallel. The most common method of management of municipal waste is still landfilling. The costs and benefits of various WM alternatives (especially the environmental impacts and costs) are not taken into account in the WM planning process in Belarus.

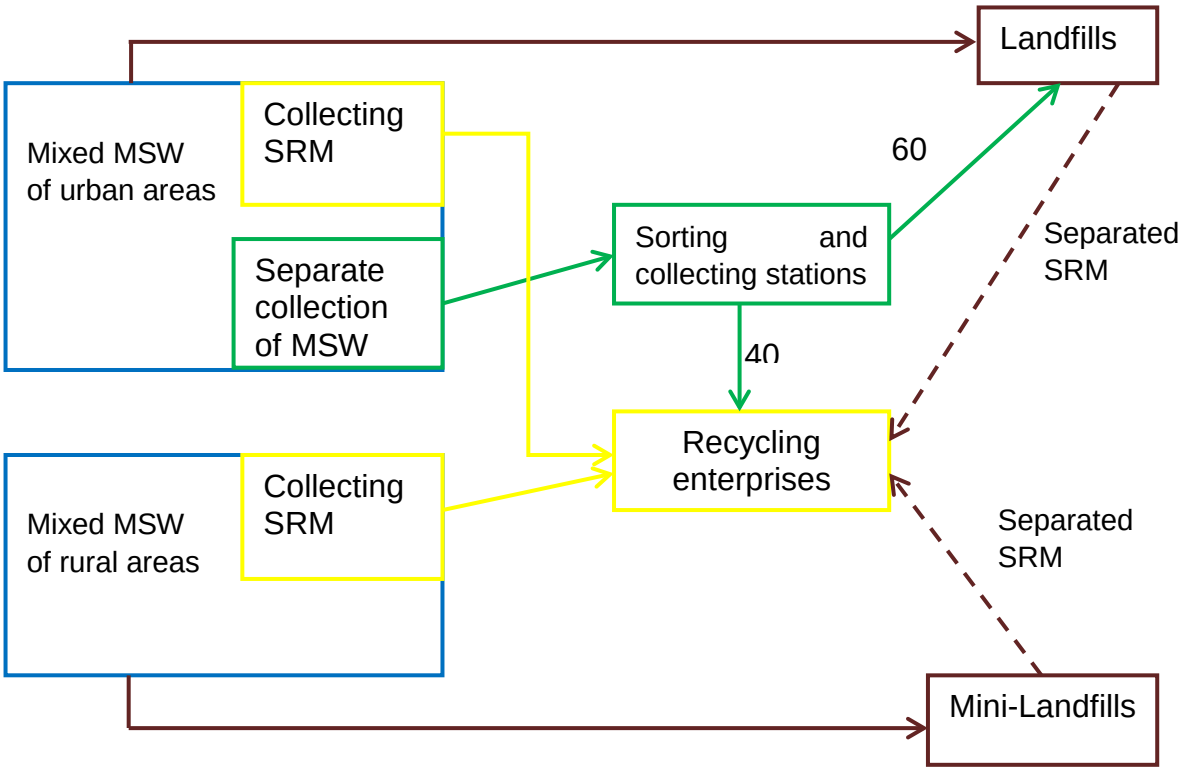

Fig. 1.3.1: Scheme of MSW management

1.3.2.2 MSW generation

MSW generation is continuing to increase over the past years (Fig.1.3.2). With higher incomes and rising consumption, MSW generation have steadily increased since 1995 (by almost 2,5 times). Waste generation per capita has increased almost 3 times: from 143,5 kg per cap per year in 1995 to 421,7 kg per cap per year in 2014 (Fig. 1.3.2).

1.3.2.3 Waste composition

The composition of different components and materials in the MSW is represented in Fig. 1.3.3. The food waste, paper and cardboard have share about a quarter of the mass. Metals, glass, polymers have a considerable share in the waste. Recycled materials and valuable resources components have two thirds of the waste. Seasonal variations of the composition of MSW are characterized by variability of the food waste from 20 – 25 % in the spring to 40-50 % in the autumn.

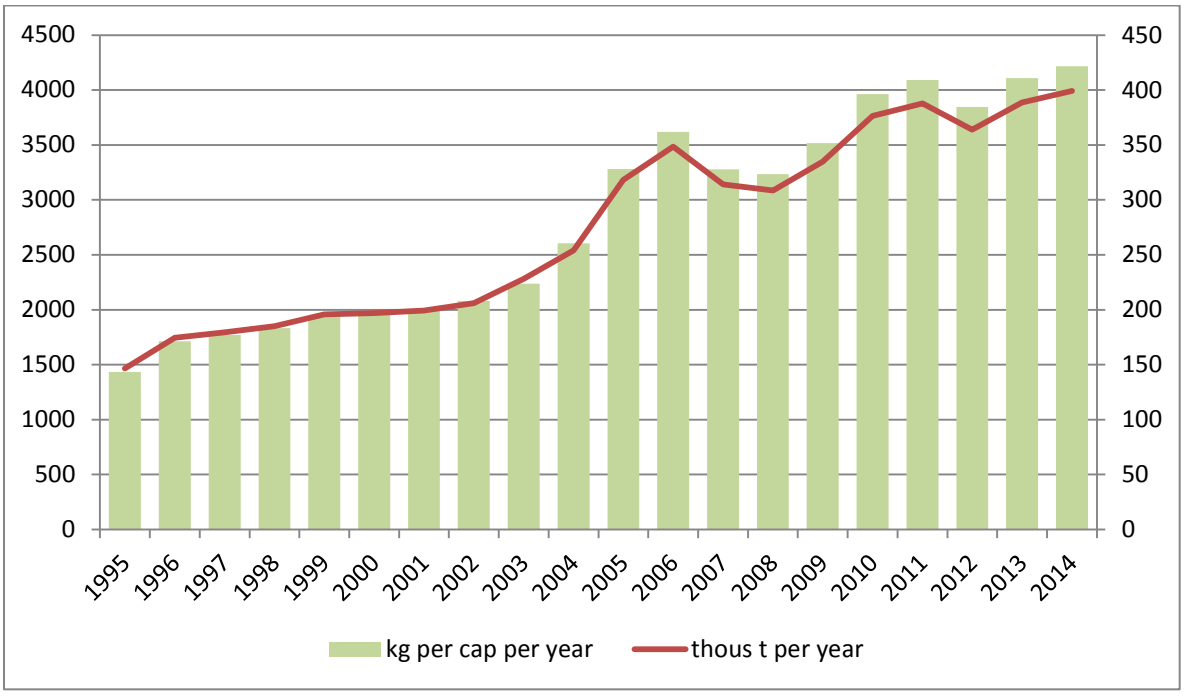

Fig.1.3.2: MSW generation in Belarus (based on state statistic data)

Considering the trend of MSW composition, one should note increasing the dangerous waste due to staidly rising of consumption of household chemicals, car care products, chemical weed and pest killers and etc. The amount of the polymer waste is fixed. The composition of various polymers in MSW is presented in Tab. 1.3.4.

Polyethylene and polyethylene terephthalate, which total share is about 74 %, obviously dominate in the composition of MSW.

Tab. 1.3.4: Composition of polymers in MSW*

Polymer	Polymer fraction share in the waste composition,%
Polyethylene	48,3
Polypropylene	7,1
Polystyrene	6,9
Polyvinilchloride	4,0
Polyethylene terephthalate	25,4
Polyurethane	1,1
Polymethylmethacrylate	1,1
Mechanical rubber waste.	4,2
Other polymers	1,9

* (Lysuho&Eroshina, 2011)

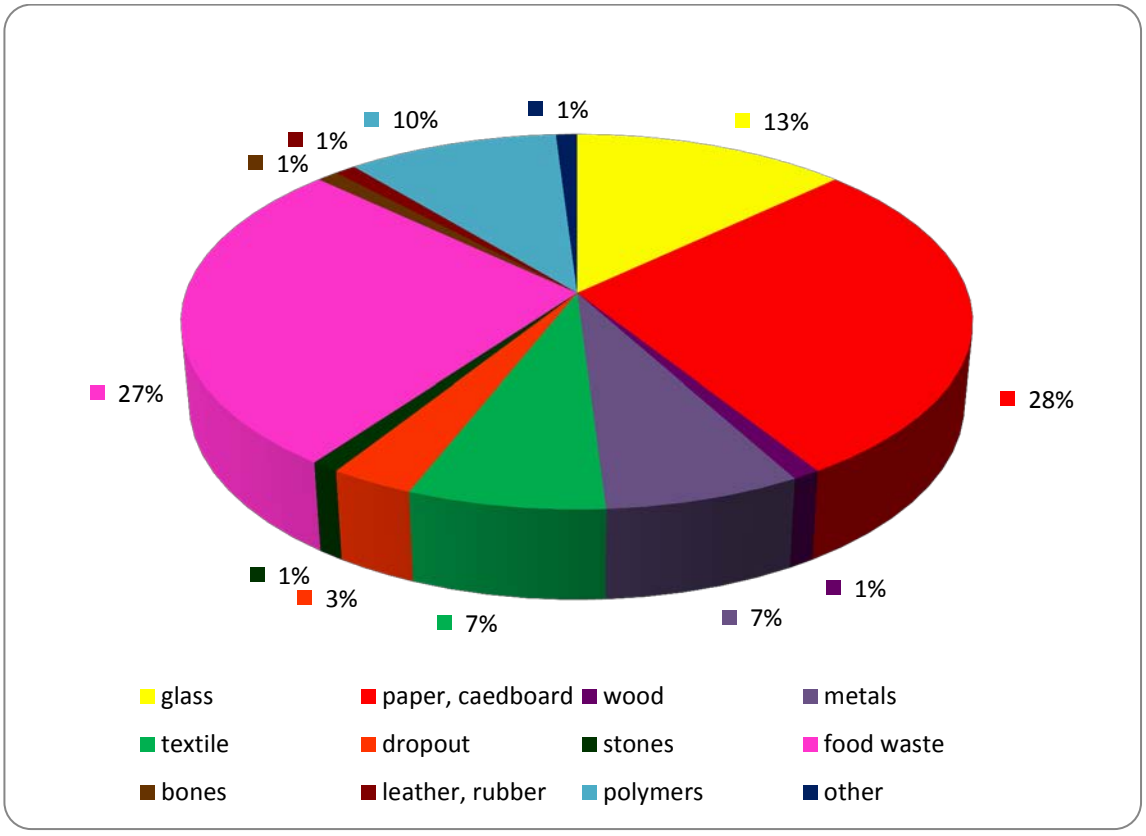

Fig. 1.3.3: MSW composition (Lysuho&Eroshina, 2011)

Averaged chemical composition of mixed MSW, humidity and ash content is presented in Tab. 1.3.5. The mixed MSW has high humidity and ash content which are made recycling more complicate.

Tab. 1.3.5: Chemical composition of MSW*

Component	**Amount, % of dry mass**
Organic mater	56-72
Total nitrogen	0,9-1,9
Calcium	2-3
Carbon	30-35
Phosphorus	0,5-0,8
Total potassium	0,5-1,0
Sulphur	0,2-0,3
Medium reaction, pH	5,0-6,5
Ash content	28-14
Humidity, % total mass	40-60

* (Lysuho&Eroshina, 2011)

1.3.2.4 Waste collection and transportation

The collection, removal and disposal of MSW was organized in 18187 settlements (2013), including 191 cities, and 17988 rural settlements (Concept of WM of MSW). Coverage by sanitary cleaning in the Mogilev region (2007) is presented in Tab. 1.3.6. Cities and towns (in total 21) are covered by sanitary cleaning on 100 %, rural settlements – on 56 % (that is on 10 % lower than the average rate for Belarus), and garden cooperatives and associations – on 71 %, slightly above the average rate for Belarus. So far, the coverage by sanitary cleaning of rural settlements and garden cooperatives increased slightly, but still has not reached 75 %.

Tab. 1.3.6: Coverage by sanitary cleaning in Belarus in 2007*

Region	Cities and towns				Rural settlements					Garden cooperatives and associations		
					Number, total		Coverage by sanitary cleaning					
	Num-ber	Popula-tion, thousand pers.	Cover age, thousand pers.	%	Num-ber	Popula-tion, thousand pers.	Num-ber	Popula-tion, thous. pers.	%	Num ber	Cove rage	%
Mogilev region	21	851,3	851,3	100	3099	317,9	1632	178,4	56,1	403	285	70,7
Belarus	191	6976,6	6976,6	100	20460	2766,09	11550	1799,62	65,1	4997	3295	66

* (Sectoral programme)

HPU organizations have (2013) 1792 specialized cars for sanitary cleaning of settlements (Concept of WM of MSW). The number of specialized cars in Mogilev region was increased by 15 %, from 156 to 185 cars during 1997 - 2013. Almost all cars (90 %) have side-loading system. Due to the increasing the consumption, rising of private cars stored near the multi-story houses, the modernization of specialized cars is

needed. Cars with back-loading system are the most appropriate for small and scramped courtyards. A fleet of vehicles is needed in updating: about 30 % of specialized cars are older than 10 years. The demand in new cars in Mogilev region is 40 vehicles per year, 10 of them are for separate waste collection.

Metal containers are usually used for collection of MSW. They have volume from 0,6 m^3 to 1,1 m^3 mostly, but the large one (12 m^3) is under operating also. About 114 thousand containers are used by HPU organizations for the sanitary cleaning in Belarus; 50 thousand of which are containers for separate waste collection (12,2 ths containers were installed in 2012). During 5 years (2007-2013) the number of containers was increased by almost a third – from 73,2 to 114 thousand items. The number of containers in Mogilev region (2007) is presented in Tab. 1.3.7. The share of containers for separate waste collection is 15 %, i.e. the number of such containers is not enough. Almost all containers have volume of 700 l. The demand in new containers in Mogilev region is about 3000, about half of them are containers for separate waste collection.

According to the data of RD of MHPU the total number of containers reached 11,7 thousands in 2015. All container sites in multi-story housing area were equipped with containers for separate waste collection. During 2015, 2313 containers were bought. With help of containers for separate collection was collected 9,2 % of recyclables from its total amount.

Tab. 1.3.7: Number of containers for mix and separate collection of MSW in 2007*

Region	Number of container sites	Number of installed containers	Including containers for separate waste collection	Including from previous column					
				700 liters		240 liters		120 liters	
				Total	Including containers for separate waste collection	Total	Including containers for separate waste collection	Total	Including containers for separate waste collection
Mogilev region	2175	8614	1357	8526	1307	58	20	30	30
Belarus	14500	73165	24836	62683	15126	6537	6120	3945	3590

* (Sectoral programme)

Coverage of urban population by separate waste collection was 3,8 % in 2003; 13,1% in 2004, 34,8 % in 2005 and 42,3 % at the end of 2006 (Sectoral programme). According to data of 2008, separate waste collection system covered 45,8 % of urban and 14,4 % of rural population in Mogilev region (Tab. 1.3.8).

The current system of separate collection of MSW is focused on the traditional separation of SRM (paper, cardboard, plastic, glass) by installing special containers. Separate collection system of MSW has the following problems: (1) the installation of containers are spontaneous; (2) there are no approved schemes of container allocation

taking into account the density of the population, the density of houses, architectural features and etc.; (3) there are no uniform requirements to containers for separate waste collection; (4) vandalism and the cultural level of citizens (in cases where usual containers for mixed waste filled up, some of citizens put away their waste to containers for separate waste collection). The quality of waste, collected in special containers is much worse in compare with the quality of waste separation at special legal entities or individual entrepreneurs. The costs on additional work (sorting) of waste from special containers are significant.

Tab. 1.3.8: Coverage by separate waste collection in 2007*

Region	Cities and towns				Rural settlements				
					Number		Coverage of rural population by separate waste collection		
	Number	Population, thousand pers.	Coverage of urban population by separate waste collection, thousand pers.	% of coverage.	Number	Population, thousand pers.	Number	Population, thousand pers.	% of coverage.
Mogilev region	21	851,3	389,9	45,8	3099	317,9	141	45,7	14,4
Belarus	188	6976,6	2951,1	42,3	16235	3034,639	743	233,27	7,7

* (Sectoral programme)

1.3.2.5 Sorting MSW

Sorting stations can be integrated into the existing scheme of collection, removal and disposal of waste from the population, as well as the process of waste separation could be mechanized at such sorting station. It should be noted that the construction of sorting stations associated with significant investment in compare to the system MSW separate collection at the places of generation.

According to Concept of WM of MSW in 2013 in Belarus there were 90 sorting stations with total capacity about 350 ths t/yr. 5 sorting lines as the part of WTP were built in Gomel, Mogilev, Baranovichi, Brest and Novopolotsk with capacity about 300 ths t/yr. The construction of these sorting stations was funded by Belarusian government. Private and foreign investments were not attracted. During 10 years (2003-2013) the number of sorting stations was increased by 15 %: from 77 to 90. Almost all sorting stations were introduced into operation in 2005-2006. Main features of sorting stations are provided in Tab. 1.3.9.

In 2013, about 270 ths t of mixed MSW were separated at the sorting stations and WTP (or about 10 % of the MSW generation). The extraction of recycled materials was 51 ths t, or about 19 % of the MSW received for sorting (Concept of WM of MSW). The rest volume of MSW is a part of the ballast and is transported to landfills. The sorting of mixed MSW is ineffective, because the cost of the sorting more than 2 times

higher than the benefit from the sale of recycled materials (due to low quality of SRM). Efficiency of sorting stations is much higher if the already separated MSW are treated.

According to the report of the RD of HPU, in 2014 in Mogilev region 6 sorting lines of collected municipal waste with capacity 5 ths ts/yr each (Klimovichsky, Kostyukovichsky, Kirovsky, Bykhovsky, Shklovsky, Osipovichsky districts) and 1 sorting line (Bobruisk) with capacity up to 20 ths t/yr were installed at expenses of Operator of recyclables. In 2015 the Operator funded the installing of 3 lines for sorting of MSW in Goretsky, Krichevsky and Mogilev districts. The results of work of these lines show a high level of use their capacity -- about 82,5 %. The level of recyclables recovery at these lines doesn't exceed 12 %, since only mixed waste comes to the sorting lines.

Tab. 1.3.9: Sorting stations in Mogilev region in 2007*

	Number	Project capacity, thousand m^3/year	Real capacity, thousand m^3/year	Volume of sorted recycled materials, tones	Including (tones)				
					Paper and cardboard	Plastic	Glass	Textile	Metals
Mogilev region	14	56,8	43,3	400,5	117,6	144,4	1,2	2,8	125,5
Bobruisk	1	23,2	20,3	186,35	44,75	113,5	20,6	0	25,5
Belynichi	1	2	2	17,58	1,18	1,4	0,5	0	14,5
Byhov	1	2	1,5	24,3	2,5	3	0,5	0	18,3
Horki	1	3,6	2,4	27,2	9,9	6,5	3,6	1,4	5,8
Klimovichi	1	2	1,4	15,37	7,3	1,49	0,03	0,05	6,5
Krichev	1	3,5	2,0	16,9	9,3	1,1	0,4	0,06	6,1
Kostyukovichi	1	2	1,2	9,9	5,5	1,2	0,5	0	2,7
Krugloe	1	2	1,2	8,67	3,3	1,11	0,1	0,16	4
Mstislavl	1	2	1,3	12,96	6	0,9	0,06	0	6
Osipovichi	1	3,5	2,2	27,04	10,9	7,8	0,04	0,1	8,2
Slavgorod	1	2	1	8,33	2	1,8	0,03	0	4,5
Chausy	1	3,5	3,5	12,02	5,45	3,01	1,2	0,7	1,66
Shklov	1	3,5	2,2	26,8	8,5	0,5	0,6	0,2	17
Dribin	1	2	1,1	7,05	1	1,1	0,05	0,1	4,8

* (Sectoral programme)

Construction of WTP and sorting stations is hampered by the lack of funds in local budgets. Taking into account the current deficit of the state budget on the investment needs, the construction of sorting stations is possible only with attracting foreign investment and loans. The economic analysis of existing sorting stations shows, that benefits don't cover the costs.

1.3.2.6 Recycling and treatment

In addition to the collection of separate waste in places of its generation the harvesting the recyclables at the collecting points of "Belcoopsoyuz", concern "Belresursy" and Minzhilkomhoz is carried out. The system of collecting points of

"Belcoopsoyuz" is a leader in the harvesting of such recycled materials as paper, textile and glass. However, the business of collecting SRM faces a number of difficulties. Firstly, the low purchase prices do not encourage people to use the opportunities of collecting points. Secondly, the network of collecting points has very uncomfortable location due to formal regulative requirements. Thirdly, collecting points are very little equipped by special presses, crushers and etc.

According to the statistic data (2011), there are 1283 collecting points were registered in Belarus, 896 of them are stationary, and 387 – mobile. In 2014, the number of collecting points was reduced to 894. Their total capacity is 450 t/yr (Concept of WM of MSW). Data on collecting points for recyclables in Mogilev region is provided in Tab. 1.3.10.

Tab. 1.3.10: Collecting points for recyclables in Mogilev region in 2015*

Name of company	Total number of collecting points	including:		Opened in 2015:	
		stationary	mobile	stationary	mobile
Belkoopsoyuz	108	87	21	1	2
Minzhilkomhoz	116	92	24	5	4
The consortium "Belresursy"	10	9	1	2	0
The rest	32	19	13	3	6
Total	266	207	59	11	12

* - based on report of RD of MHPU

8 cars with manipulator, 3 lorries and 4 vertical presses, 4 platform truck were obtained to equip the collecting points in 2015.

About 80 ths t of SRM are annually collected at collecting points. Widespread types of collected SRM are paper and cardboard (75 % of the total amount). For comparison: the dominant type of collected SRM through the system of special containers is plastic (74 %). Waste collected through collecting points has high quality. However, the cost of waste collection at collecting points is much higher than the cost of collection through the system of special containers. That why poor takes away SRM from special containers and earns money at the collecting points for recycled materials. This reduces the efficiency of both systems.

Recycling facilities are usually built for environmental reasons and require governmental subsidies in their construction and operation. Recycling facilities are listed in a special Register. The Register is kept by MNREP and uploaded at its web-site. The register must be used by all waste generators in the procedures of the development of instruction on WM, as well as territorial offices of MNREP in the procedures of approval and control of norms of waste generation, limits of landfilling and etc. Register is made in accordance with the nomenclature of the waste from Waste classifier. In the case, when at least one treatment facility operates with the certain kind of waste, the last one

could not be landfilled (one exception – the official refusal of recycling plant). Register is divided into three parts: facilities for the (1) disposal, (2) recycling and (3) landfilling. The list of recycling facilities includes about 500 plants (which take waste from other legal entities or individuals). The structure of treatment facilities (% of total number of registered objects) is shown in Fig. 1.3.4. Recycling plants treat 941 kind of waste. The larger part of recycling materials is plastic (23 %), wood (20 %), construction waste (15 %), oil products (14 %). Totally, share of mentioned types of waste is about ¾ of recycled materials.

Paper and cardboard. About 90 % of paper and cardboard is collected at collecting points. Currently, the main consumers of recycled paper are 7 companies which are part of the Belarusian production and trading concern of forestry industry. The total demand in the recycled paper is about 430 ths t/yr.

Glass. Annual volume of generated glass waste is 150 - 200 ths t. About 20 ths t of glass waste is generated in the industrial sector and moved to the enterprises of the glass industry directly. Based on morphological and fractional composition of municipal waste, MSW contains about 130 - 150 ths t of glass waste. The main consumers of glass waste are Glass factory “Elizovo”, “Belevrotara”, “Gomelsteklo”, “Brest KSM”, “Grodno Glass”. The glass waste is used as additive material to the basic components of glass.

Plastic. Annual volume of generated plastic waste is about 300 ths t. Plastic waste consists of:

- plastic packaging, including bottles made of polyethylene terephthalate (PET), 31 ths t;
- polyethylene and polypropylene films - 100 - 120 ths t;
- other waste (plastic parts of household appliances, kitchen utensils, toys, sports equipment, linoleum, pipes, etc.) - 150 ths t.

Since 2003 Belarus has built plants for recycling of plastic waste with total capacity of 16 ths t. At present times, these plants are underused due to lack of raw materials. About 4 ths t of plastic waste (PET) are annually collected and recycled in Belarus, or 20 % of generated of such type of waste. The level of recycling for other kind of plastic waste is only 12-14 %. The large part of plastic waste generated in households is heavily contaminated and consists of destructed polymers. All of these make the recycling more complicate and expensive.

Textile. According to experts, annual amount of textile waste is about 150 ths t. About 6 ths t is generated at the factories of light industry and moved directly to recycling facilities. Recycling of textile waste is carried out by plants, which are the part of the group “Bellegprom” and “Belcoopsoyuz”. Production capacity for processing of secondary textile materials is about 10 ths t / yr in the country.

In 2013 the aggregate demand in paper waste was estimated at 392 ths t / yr while the collection was 28,4 ths t / yr. The demand in glass waste was estimated at 145

ths t, while the collection was equal to 83 ths t. The textile waste collection capacity exceeds processing capacity by three times (Survey..., 2016).

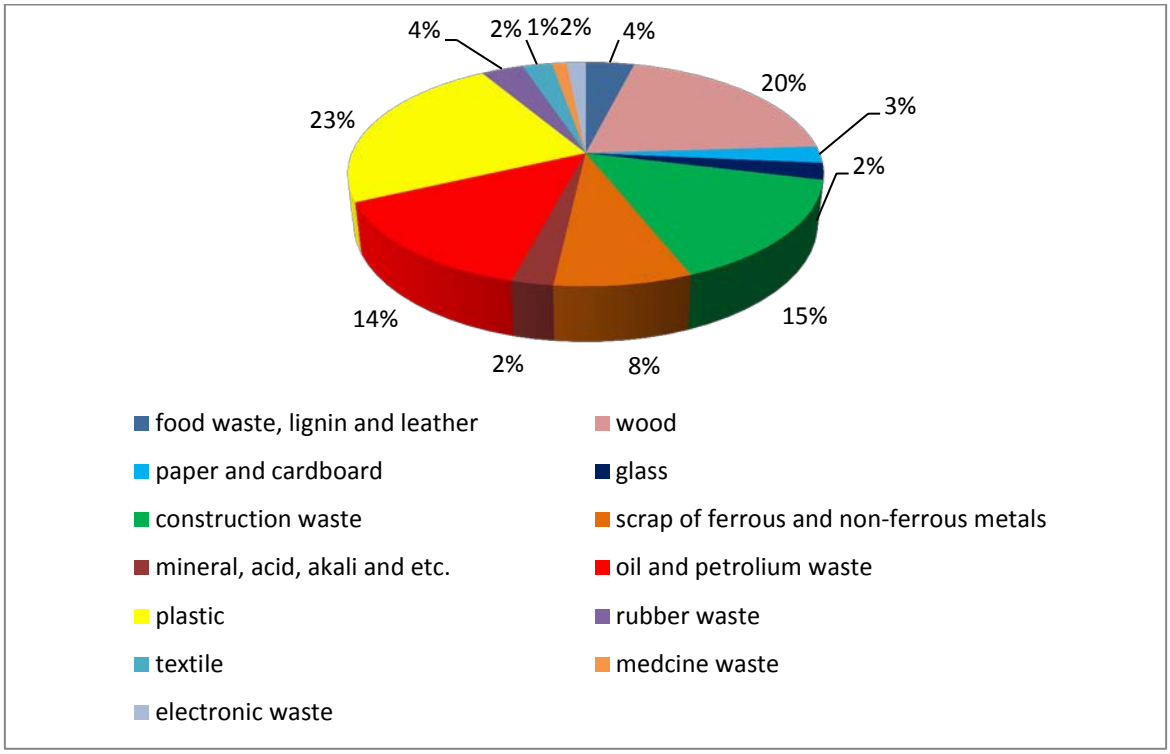

Fig. 1.3.4: Recycling facilities in Belarus

Electronic waste. Annually, about 150 thousands of refrigerators, 260 thousands of TVs, 90 thousands of washing machines are broken and out of operation. The system for collection and recycling of electronic waste is under construction in Belarus. The amount of collected waste is very low.

Automobile waste. Waste generated by vehicles belonging to individuals consists of two components (1) the waste generating during the operation of the vehicle and (2) the waste generated during the disposal of vehicles. The annual number of autos needed in recycling is 50 thousands. Deferred demand in auto recycling (accumulated fleet vehicles which are out of operation) at the current moment is about 200-250 million units and continues to increase. The annual amount of waste generated during the operation of autos, are: oil - 13 - 15 ths t; brake and cooling liquids – 0,5 – 1,0 mln t; used oil and fuel filters – 1,7 – 2,0 mln t; defective batteries – 2,5 – 3,0 mln t. Such waste is almost not utilized from population in Belarus.

Used tires. Every year about 64,5 ths t of used tires are generated in Belarus. Currently waste tires used as alternative fuel by public company "Krasnoselskstroymaterialy" and by "Belarusian Cement Plant".

Hazardous waste. Galvanic elements are the most common type of hazardous waste generated at households. The total amount of their generation is about 3,7 ths t/yr. Currently, the collection of galvanic battery waste from population is at the stage of the installation of special containers. Advanced technologies for utilization of galvanic batteries are not available. The 1000 containers were installed in shops and some public organizations. The specific problem is mercury-containing waste in mixed MSW. Assessment of medical waste generated at households was not made in Belarus. Currently, this problem is not considered as relevant by governmental agencies.

Waste oil. Management of petrochemicals industrial waste is well developed. At present, almost 90 % of the collected waste oil is utilized as fuel or used in plants. The waste is burnt in boiler-houses and others facilities for heating and energy production. Several plants process oil-based waste to produce on its base fuel. According to the National Statistical Committee, 2500 tons of waste oil was collected in 2013. The State Association "Belarusian Railway" is engaged in processing of waste oil, oil slime, oil-water mixture forming during rail transits. The plant capacity is 9500 m^3 per year for oil-water mixture and 1700 m^3 per year for oil slime (Survey..., 2016).

Utilization of ferrous and non-ferrous metals is fulfilled separately from the municipal waste. These metals are collected by the metal waste purchasing network which is subordinated by the SU "Belvtormet". In 2013 the enterprise produced 773 ths t of ferrous metal and 15 400 t of non-ferrous metal. 86,6 % of the collected scrap of ferrous metal is the scrap of steel, and the biggest part of the collected scrap non-ferrous metal is a scrap of aluminum (50,6 %). The collected metals are used for producing of different goods at enterprises under the command of SU “Belvtormet” or sold by the Belarusian Universal Commodity Exchange (Survey..., 2016).

In Mogilev region the main recycling plants are

- waste paper - Paper factory “Spartak” (Shklov);
- plastic waste - "RePlas-M" (Mogilev), “Recycling plant” (Mogilev), SAE (Mogilev);
- glass waste – Glass factory “Elizovo” (Osipovichi district);
- used tires – “Danoton” (Mogilev), “Krichevcementnoshifer” (Krichev) and “Belarusian Cement Plant” (Kostyukovichi);
- scrap ferrous metals – “Vtrochermet”;
- scrap of non-ferrous metals – “Beltsvetmet”;
- batteries and WEEE – “Bel VTI”.

In 2012, paper factory “Spartak” recycled 35 ths t of waste paper, and the Glass factory “Elizovo”- 9,8 ths t of glass waste.

Technologies for the extraction of “landfill gas” was started to implement at MSW landfills in Belarus. Produced landfill gas is used for burning and electric power generation. In 2013 were introduced into operation 5 facilities at landfills in Vitebsk (capacity 1 megaWatt), Orsha (capacity 0,2 megaWatt), Gomel (capacity 1,3 megaWatt), Minsk (capacity 2 megaWatt and 2,8 megaWatt) (Concept of WM of MSW).

In general, in 2013 the collection of traditional recycling materials (paper, glass, plastic, textile, used tires) was 454,1 ths t, or about 12 % from total amount of generated MSW. HPU organizations collected about 20 % of recycling materials. The amount of collected SRM (including paper, glass, plastic, textile, rubber, construction waste) increased in 5 times in compare with 2008 (Fig. 1.3.5). The amount of paper waste increased 2,2 times and was 22 ths t. The amount of glass waste increased 4,3 times (Fig. 1.3.5).

Indicators of regional program for recyclables collection in Mogilev region in 2015 were conducted (based on Report of RD of MHPU):

- paper and cardboard - on 71,1 % (36893,4 tons of tasked 51900,0),
- glass - on 103,3 % (19624,9 tons of tasked 19000,0),
- polymers - on 108,0 % (7884,8 tons of tasked 7300),
- textile - on 79,4 % (953,2 tons of tasked 1200,0),
- used tires - on 102,5 % (9536,8 tons of tasked 9300,0);
- construction waste - on 100,6 % (17000,1 tons of tasked 17000,0).

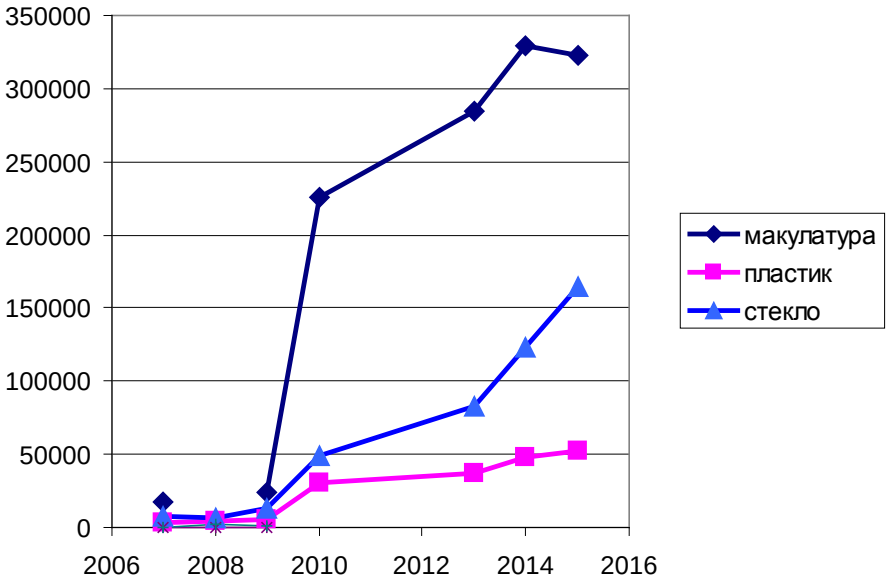

Fig. 1.3.5: Collection of recyclables in Belarus

1.3.2.7 Landfilling

Relatively low capital costs of landfill construction in compare to other waste disposal methods led to the fact that landfilling is the most common practice of MSW treatment. Landfilling includes two steps: (1) accumulation of mixed MSW at temporary storage sites, mainly in containers, and (2) transportation to landfills on a regular basis or removal of waste upon requests of enterprises and individuals. Waste transported to landfills is leveled, compressed layer-by-layer and insulated with inert material. Until

recently, waste was dumped close to places where it was generated, including uncontrolled dumps. Industrial waste, similar to MSW, generated in organizations and plants, as well as industrial waste of non-dangerous and 4 class of danger are also landfilled. The share of such kind of industrial waste is about 30-35 %. Especially large part of industrial waste is landfilled at dumps of MSW near large cities. In addition, municipal, industrial and hazardous waste are landfilled together, creating dangerous toxic conditions.

According to (Concept of WM of MSW), in 2013 there were 164 landfills and 2755 mini-dumps in Belarus. The trend is to close small facilities. The total area of landfills is about 3 000 ha. Over 40 % of the landfills have exhausted their operating capacity.

Engineering and geological surveys were not carried out at most dumps constructed before 1991, so the owners of the objects do not have information about the hydrogeological characteristics of the landfill area. The passports of the wells, if they have been made, are often missed, and therefore data on geological and lithological composition is lost. Sand and sandy loam with high filtration properties are at the base of many of wells. 74 % of the landfills have a network of the monitoring of groundwater, which usually consists of 2-5 wells. Average well depth varies from 4 to 10 m, rarely reaching 15-25 m. Local groundwater monitoring is carried out at 112 landfills of MSW. The monitoring of surface water, soil and air at the waste facilities impact area is carried out episodically, unsystematically (Lysuho&Eroshina, 2011).

Landfills do not meet sanitary rules, such as using liners and collection systems for leachate. 112 of the 164 landfills have protective insulating screens, 91 landfills have weighing equipment. Before the stopping of many legal and illegal disposal sites, they are needed in the rehabilitation in order to protect the environment and humans' health.

Currently, 21 city landfills, 243 MSW mini-landfills and 258 temporary waste storage site are in operation in Mogilev region. Performances of landfills of Mogilev region are presented in Tab. 1.3.11. Improvement of existing landfills and reclamation of closed mini-landfills are carried out in the region annually. In 2012 landfills in Mogilev region have received 300 ths t of municipal waste. Waste composition consists of the SRM up to 60 %: paper and cardboard, glass, plastics, metals, textiles, leather, rubber, household appliances and other wastes, including hazardous wastes.

Tab. 1.3.11: MSW landfills in Mogilev region*

	Number	Capa-city, thous. m^3	Amount of landfilled MSW, thous.m^3	Power headroom, thous. m^3	Lifetime, years	Project area, hectares	Occupied area, hectares	% of capacity use	Height of bulk layer	Environment protection facilities	
										protective shield	Well of water moni-toring
Region	21	16719	7112	9607	4>30 years	102,5	49,007	2>80 %	2>10 m	18	17
Mogilev	1	3107	1129	1978	8	13,2	4,75	36	16	*	*
Bobruisk	1	4660	1864	2796	26	14,3	8,58	60	8,6	*	*
Belynichi	1	528	25,8	502,2	2	3,09	0,155	5	2	*	

Byhov	1	780	16	764	1	1,5	0,03	2	2	*	*
Horki	1	1572,2	830,2	742	14	4,6	2,16	47	2	*	*
Glussk	1	273	242	31	31	4,5	4,01	89,1	1,5		
Klimovichi	1	450	270	180	11	3	1,8	60	12	*	*
Krichev	1	733	359	374	15	4,82	2,36	49	6	*	*
Klichev	1	100	12	88	29	2,1	0,252	12	2	*	*
Kostyukovichi	1	680	170	510	6	7	1,75	25	1,3	*	*
Krasnopol'e	1	250	150	100	12	5,5	3,3	60	5	*	*
Krugloe	1	228	114	114	20	1,2	0,6	50	6	*	*
Kirovsk	1	1300	1105	195	45	6,7	5,7	85,1	1,5		
Mstislavl	1	108	32	76	15	4,1	1,23	30	2	*	*
Osipovichi	1	556	139	417	8,7	2,2	0,55	25	4	*	*
Slavgorod	1	240	204	36	17	30,4	2,89	85	4	*	
Khotimsk	1	233	8	225	33	2	0,04	2	1,7	*	*
Chausy	1	275	152	123	26	6,1	3,36	55,1	2		*
Cherikov	1	360	208	152	10	5	2,9	58	2,5	*	*
Shklov	1	236	48	188	6	6,15	1,23	20	1,5	*	*
Dribin	1	50	34	16	9	2	1,36	68	2	*	*
Belarus	167	239798	206609	33188	36> 30	780.7	465.68	48> 80 %		112	112

* (Sectoral programme)

1.3.3 Legal and economic instruments to support waste management hierarchy

Regulations on processing MSW in Belarus include established “norms” of waste generation. They are calculated on the base of material and source balance of production process. The waste disposal “norms” are calculated on the basis of the portion of the SRM in the total value of generated waste. On the one hand, this method establishes the basic level for control over plants, but, on the other hand this can influence the decision of the waste producer to give in reports the "desired" data in accordance with approved figures (Survey..., 2016). “Norms” are approved by local and regional executive bodies.

Financial instruments are set to achieve the full recovery of MSW management costs. The plants engaged in the waste collection and removal in every region have to calculate and report the collection, removal and disposal costs on the base of the prime costs compared with the reduced tariff (real cost for population). Data analysis is allowed to compare the tax for the waste collection and removal in the different regions and to estimate the governmental subsidies (Survey..., 2016).

The tariffs for MSW removal and treatment do not correspond to the real economic costs and do not include the cost of the development of new technological processes (separate collection, recycling). Cross-subsidization of tariff regulation (i.e, when the tariffs on the MSW removal and disposal for legal entities are much higher than for the population) is used for the de-monopolization of this sphere. But in practice, in some cities it has led to lobbying and attraction of the companies specializing in providing services for the removal of MSW only for legal entities. Financial resources, obtained by

higher tariffs for legal entities and previously used to finance the system of MSW collection and removal from the residential sector, now are redistributed in favor of certain private companies. These companies are not burdened with the organization of the system of MSW separate collection in the residential sector and are almost free in using of it for their own commercial purposes for providing MSW removal services only for legal entities.

Under the President's Decree № 313 "On Some Issues of Consumer Waste Disposal", the procedure for implementation of EPR is established; and the list of goods coming within the purview of the law are constituted as well as amount of consumption waste and recycle package. Retailers have to make room for collection of the secondary resources and packages at their area. The level of the secondary resource collection in 2015 is 15%, in 2017 – 20% and in 2020 – 30%, Package collection level in 2015 is 35%, in 2017 - 40% and in 2020 – 50%. There are no reports on achieving these indicators. The order of the Council of Ministers № 708 of 2012 amends the President's decree № 313 and establishes the payment should be made by suppliers and producers of goods lost their consumer properties, as well as for the organization of collection of waste and package.

1.3.4 Waste management system financing

The tariff policy in the field of public services is approved by President in its entirety. President of the Republic of Belarus (1) sets up state bodies and organizations establishing and regulating the public services pricing; (2) approves the procedure of calculating of the public services pricing. President's decree from 25.02.11 № 72 "About some questions of price regulation (rates) in Republic of Belarus" approves that regional executive committees and Minsk Cite Executive Committee controls prices (tariffs) for: the removal and treatment of MSW; the service of removal of the wastes generated in the garden cooperatives.

President's decree from 06.10.2006 № 604 "About measures for increase of overall performance of housing and communal services" (Decree № 604). According to a.1,9 of Decree, pricing for public services (MSW removal and treatment) has to be set in the view of the population incomes. Decree № 604 establishes that the expenditures on the MSW removal and treatment services are partly compensated by removal and treatment tariffs for legal entities. Regional executive committees and Minsk City Executive Committee set up tariffs in view of possibility of partial compensation of the services costs for population. In addition, the Decree № 604 establishes that the public services costs are not compensated by legal entities should be compensated by regional budgets and Minsk city budget. Legal entities pay almost three times more than population. This gap slightly narrowed in 2009 (Document of the World Bank, 2010). According to the data of 2015, the received money for MSW collection, removal and storage from population covered about 85% of costs.

According to p.47 of the Instruction №13 the calculation of the payment for MSW collection, removal and treatment is fulfilled on the basis of the "norms" of MSW generation per one person and is approved by the local executive authority. So, the consumer (population) payment for MSW removal and treatment is not based on the real quantity of the services (real waste quantity removed to the landfill), but on the basis of the MSW generation "norms". Current Belarusian legislation allows covering all costs for removal and treatment of MSW only in 2 ways: (1) by increasing the tariffs for removal and landfilling; or (2) increasing "norms" of MSW generation per person.

The removal and landfill tariffs in Belarus do not distinguish the payment for these two components. This is not a problem if, as it usually occurs in Belarus, the removal and landfill services are rendered by the same organization. Nevertheless, in Minsk where these two activities are separated, the company running the waste landfilling has to subsidize the landfill at the expense of the income from the waste sorting and others activities (Survey..., 2016).

To keep the course of improvement of the financing MSW management it is necessary:

- to set up tariffs for different operations with consumption waste;

- to realize the possibilities to pay for waste serves on the basis of the real amount of waste; and at the same time include on occasion the calculation of the service payment according to "norms";

- to sign agreements with the population on extended services on the waste management, in particular on collection of SRM, transportation and sorting bulky waste (Gnedov, 2012);

- to cut cross-subsidization: to re-arrange tariff policy, to establish and enforce new economic instruments for calculation of fees for MSW collection, removal, treatment and disposal.

1.3.5 Public awareness, education and communication initiatives

The soviet system of propaganda of resource saving, recycling and separate waste collection is completely lost. At present, several initiatives are realized in Belarus mainly by social organizations with the financial support of international fund organizations and volunteers.

Development of the e-resource "Green map". «Green map» (http://greenmap.by/o-proekte) – is the web-page collected information about environmentally significant objects: collecting points for waste and recyclables; organizations which are in charge for environmental protection; renewable energy sites; unique natural sites and etc. «Green map» is a public project implemented by Center of environmental solutions with support of international project «Facilitating the transition of the Republic of Belarus to the "green" economy», financed by EU and UNDP

program. Project «Green map» is developing with help of volunteers who check, update data and answer the user comments.

Target 99 (http://www.target99.by/) is a project implemented by Operator of recyclables. At the same time on the official project web-page Target 99 is described as a “civil movement, open for everybody who wants to join”. The project aim is to sort and treat 99 % of MSW. Official explanation “why 99, not 100 %” sounds as “99 % is a symbol of our attempt to get maximum with understanding that there is no full perfection. Not only result is an important, but moving to the right direction”. Under Target 99 there are a lot of information materials were developed (posters, video clips, booklets and etc.). Target 99 organizes special competitions for schoolchildren in collection of recyclables.

Let do it ! (Зробім!) (http://www.letsdoit.by/). Belarus joined to world action Let’s Do It! Cleanups under «Let`s Do It!» initiative were started in 2012 in Belarus. In 2015 about 1500 people participated in actions around Belarus, they organized 60 cleanups and collected 122 tons of waste. The executive committee of the movement consists of representatives of governmental and non-governmental organizations engaged in environmental protection and sustainable development: Center of environmental solution, Green network, foundation “Interaction”, NGO "Minsk Cycling Community", MNREP, MHPU. But the main persons in action are volunteers. The movement became popular in contrast to obligatory “Subbotniks”. A number of active volunteers continue the action during the whole year.

Belarus took part in the EU project "Waste management -- European neighborhood and partnership instrument: the East region" in 2009- 2013 with the total budget of 5,8 million euro. During this project Pukhovichskiy raion was chosen as a pilot district for inventory of the landfills, development of new strategy on WM and designing of modern landfill. The EBRD deals with the problem of financing of the regional landfill construction according to the EU standards and equipped it with a sorting line, the waste composting facility, and also with transport and equipment for improvement of the waste collection and removal process from the Pukhovichskiy and Chervenskiy districts (Survey..., 2016).

During 2011-2014 the project “Promoting the development of a comprehensive framework for international cooperation in the field of environmental protection in the Republic of Belarus” was implemented with support of EU and UNDP (project budget is 5 159 469 euro). National and international experts made suggestions on improving legislation in the field of environmental protection, waste management, biodiversity conservation, water management, as well as environmental certification (Survey..., 2016).

One of the example of public initiative is a pilot project on the MSW management in towns Kobrin and Mosty. More information about project could found in the report, see (Bendere, 2013).

The World Bank granted a loan of 42,5 million $ for the implementation of the "Municipal Solid Waste management in the Republic of Belarus". The project is supported designing, construction and control of building of new sorting plant with total capacity 120 ths t/yr in Grodno, as well as improvement of MSW separate collection (Document of the World Bank, 2010).

1.3.6 Barriers and success factors for waste management performance

The existing barriers of MSW management in Belarus are:

1. For the population the current tariff level for housing and municipal services on the removal, recycling and burial of MSW and prices on SRM does not cover the cost of a full management cycle of MSW (collection, removal, sorting, recycling, neutralization and burial of MSW), and it is doesn't allow to attract investment to build facilities for sorting and recycling of MSW and to develop a competitive environment of MSW management.

2. The system of MSW separate collection requires further development and investment to create the necessary infrastructure. It also requires an information work with the population. Low level of the environmental culture leads to blockage of the system of separate waste collection. Education and awareness of the population have to be considered as a crucial point in the MSW management. It is necessary to develop and strengthen existing communication initiatives.

3. Many of the technological concepts for the MSW management are approved without the development of the regional (city) programs for the MSW management and their connection with the existing system of collection and burial of MSW and regional specific conditions.

4. In order to implement the principle of «if you litter – you pay» the current legislation requires detailing and making the new approaches to formation of the tariff policy.

5. Lack of the institutional mechanisms for the collection of some types of waste from the population: hazardous wastes (mercury-containing waste, medical waste, electronic waste), automobile wastes and some other.

6. Short list of waste collected from the population separately. Settlements must have the special centers of waste collection where citizens can deliver generated waste (cardboard, paper, plastic, paint tins, batteries, building material, home appliances and so on) by themself.

7. Limited demand on recyclables. To stimulate the use of waste for receiving recyclables and energy Belarus should prohibit landfilling, and existing mini-landfills should be enlarged or liquidated. At the same time, the soviet instruments and mechanisms stimulating the collection of recyclable should be used, for example, involving retail companies, social organizations, as well as implementation of the principle of EPR.

8. Complicate system of waste governance. At present 6 Ministries are in charge for WM.

9. At present, HPU organizations are in charge for MSW management. They are responsible simultaneously for long list of other municipal services, mainly unprofitable. Special organizations should be established for MSW collection and treatment. In this case the room to improve MSW management will be created.

10. Licensing in the field of recycling and MSW management limits the private initiatives. Private companies could develop improved system of MSW management due to their mobility and attract international investments.

11. It is necessary to implement special programs on Eco-labeling and Eco-design.

The success factors are included in the Concept of WM of MSW which assumes:

1. To develop the logistical basis of collection (provision), transport and use of SRM; to increase the number of standardized containers for separate collection of MSW and equipment for their maintenance; to design new apartment houses without garbage chutes; to close the existing garbage chutes and to build the container platforms for the separate collection of MSW.

2. To expand the network of receiving and storage centers for SRM, including the organization of SRM collection based on trading facilities.

3. To establish the centers for separate waste collection (to organize special sites for the population, equipped with containers for waste delivery and sorting by waste types free of charge).

4. To develop the own waste collection systems by manufacturers and suppliers of goods and package as a part of the principle of EPR.

5. To carry out reconstruction, modernization, and renovation of existing facilities for sorting and preparing to use of SRM.

6. To construct of new plants for the recycling of SRM in view of their economic efficiency, to expand the range of the recycled SRM and goods made from recyclables.

7. To improve the legislation of MSW management and SRM management and to unify it within the participation of the Republic of Belarus in the EurAsEC: to improve the mechanisms of stimulation and involvement of the population in separate collection of MSW and storage of SRM including tariff regulation; to develop legislation on the deposit system of treatment of certain container types; to improve the mechanisms of economic incentives for entrepreneurial activity in the collection and use of SRM.

8. To improve the tariff policy.

9. To attract investments in facilities of MSW sorting and recycling.

10. To develop a competitive environment in MSW collection and removal, to carry out the implementation of public-private partnership mechanisms.

1.4 Description of waste management in Case study City/Region of Belarus

1.4.1 Overall background

Mogilev city is a regional center of eastern Belarus, the third largest city of Belarus. It was founded in 1267. Current area is 118,5 km^2. Mogilev district was established in 1924. Its area is 1895,4 km^2. There are 276 rural settlements in Mogilev district, which are united into 15 rural councils – “Selsovets”. The dominant type of rural settlements is small village with population less than 100 people.

1.4.1.1 Physical environment of Mogilev city and Mogilev district

Geological environment and underground water

The territory of Mogilev is situated on Mogilev Mulda of Orsha depression. The structure of the platform cover includes sediments of dalslandskij, nizhnebaykalskij, Hercynian and Cimmerian-Alpine structural complexes.

The area of Mogilev is located within Orsha basin of underground water. The anthropogenic sediments and old-Oskol Middle Devonian horizon with a total capacity of up to 230 m enclose large hydrocarbon reserves of fresh water with mineralization up to 0,4 g/l. Therapeutic mineral water was found near the village Vilchitsy. Polykovichskii source has the curative effect of the water too.

Drinking water supply of Mogilev is carried out from artesian sources. All produced artesian water is cleaned in the iron removal plants and meets all health standards. Currently 7 group water intakes, owned to MUE "Gorvodokanal", provide Mogilev by drinking water. Operating groundwater reserves are 236 ths m^3 /day, with possible delivering 191,2 ths m^3 / day. The volume of water supplying is about 90 ths m^3 /day. For industrial water needs the water comes from the 6 water intakes. During last decade, the volume of fresh water use is reduced. In 2012 the water use was 38,6 million m^3.

Relief and soil

The relief of the city is quite diverse and is characterized by significant elevation changes - up to 60 m with respect to the level of water in the river Dnieper. The specific of the relief of Mogilev is the river valley of the Dnieper. According to the scheme of geomorphological zoning, Mogilev area is situated on Mogilev moraine-water-glacial plains. The least stable areas (from geomorphological point of view) include the original bank of the Dnieper valley, and especially the banks of small rivers, heavily dissected by ravines. The other unstable area is the north-eastern part of the city, where a significant height differences are combined with the unstable rock. The area of moraine plains is characterized by the most stable conditions to different types of impact.

The most common are sod-podzolic soils (75 % of Mogilev area). The most common soil type in the catchment area is sod-pale-podzolic and sod-podzolic weakly - and middle-podzolic soil on moraine loams.

Climate and weather conditions

Mogilev climatic type is temperate continental. The total sum of solar radiation is 3809 MJ/m ^{2} (90,9 kcal/cm $^{2)}$. The total amount of sunshine hours is about 1800. 44 % of them shined during three summer months and 8 % - during three winter months. The absolute maximum of air temperature was observed in August, 2010 and was + 36,8 °C, the absolute minimum was in January, 1940 (-37 °C). The average annual temperature in Mogilev is 5,4 °C.

Mogilev is characterized by high relative humidity (over 80 %). The annual sum of rainfall is 679 mm. There is 182 days with precipitation. 2/3 of the rainfall is observed in April - October. 72 % of precipitation fall dawn in a liquid form, and 15 % - in the solid form and 13 % - in mixed form.

The average wind speed in the open area is 3,8 m/sec, is slightly higher in winter (4,4 m/sec in December) and lower in the summer (2,9 m/sec in August). The winds of all directions are almost equally, in the cold season South and South-east winds are dominated, in the summer – north-west winds, and in the autumn – west winds. The maximum of observed wind speed is about 25-30 m/sec.

Mogilev, like every large city, creates a special urban microclimate. In the center of the city the temperature can be higher on 2-4 °C in compare with the temperature at the meteorological site situated on the outskirts. The humidity is below (due to asphalt pavement). The number of days with snow, strong winds is lower, but with fogs is higher.

Air pollution

Air pollution is at the top of city environmental problem. Atmosphere monitoring in Mogilev is currently conducted at six fixed stations of “Mogilevoblgidromet” and at one station of Hygiene and Epidemiology City Center, as well as at sanitary protection zones of industrial enterprises. The sources of urban air pollution are emissions from stationary and mobile sources; and the contribution of mobile sources is 75-80 % of total emissions.

22 atmosphere pollutants are monitored, 18 of them are key pollutants (sulfur dioxide, nitrogen, carbon monoxide, nitrogen, formaldehyde, phenol, suspended solids, 3,4-benzo(a)pyrene, etc.) and four ingredients are specific (methyl alcohol, carbon disulfide, hydrogen sulfide, ammonia). Heavy metals (copper, lead and cadmium) are also monitored in the atmosphere. Mogilev has the widest range of monitoring pollutants among all cities of Belarus. Main stationary sources of air pollution of Mogilev are energy, machine building and chemical industries as well as transport emissions. The spatial city planning contributes to air pollution. Pollutants are concentrated in the city center and residential areas because locations of plants at the hills. The enterprises in

the western industrial zone have the greatest impact on urban air pollution, especially by specific substances.

In 2012, there was observed decreasing the air pollution by basic and specific substances. However, in some areas of the city the problem of pollution by nitrogen dioxide and by formaldehyde is continuing to impact on city environment.

Surface water

The territory of the Mogilev city has well-developed hydrographic network. It's the largest part belongs to the watershed of the Dnieper. Only a small area in the southern part of the city has a drain to small bodies of water, deprived of hydrological connection with the Dnieper as a result of human activities. The Dnieper divides city into two parts, the river is flowing through Mogilev from the north-east to south-west. The length of the river within city boarders is 8,6 km, the width is about 90 m and ranges from 70 to 150 m. Average flow speed is 0,1-0,2 m/sec, the water flow rate is 139 m^3/sec. River water is bicarbonate-calcium with mineralization of 45-121 mg/l. As a result of the impact of anthropogenic objects, as well as runoff from urban areas the hydrochemical regime is significantly transformed. Small rivers the Dubrovenka, the Debra, the Strushnya runs through Mogilev. *The most significant small river is the Dubrovenka River,* which has length about 18 km. The river discharge is well regulated (at the site of Pechersk dam it is 0,084-0,096 m^3/sec.). The valley of the Dubrovenka is intensively used for several centuries. Dominant type of land use is a one-story wooden individual households. The river is polluted by organic, nutrients and suspended substances, as a result the water of the river and the river valley are heavily polluted, and has strong negative effects on the human health.

Flora and fauna, forests

The green area of Mogilev is 3295,4 ha (2009). According to data of MNREP, dynamics of provision of public vegetation in Mogilev during the period from 2004 to 2009 did not be changed and was about 40 m^2/person.

Natural vegetation in Mogilev almost wasn't preserved. Natural ecosystems could be found only in the forest parks (Lyubuzhsky and Pechersky) as well as in the floodplains of the Dnieper and the Dubrovenka rivers. The most widely spread types of vegetation in Mogilev are: (1) man-made tree plant associations (forests with anthropogenically degraded underbrush (parks, gardens), (2) tree plant associations mixed with multistory residential areas and (3) tree plant associations mixed with individual households). A significant part of city (about 15 % of the city area) does not have vegetation (industrial, transport and storage areas). The most popular species for greening are linden, horse chestnut, maple, birch, ash, mountain ash, poplar, and shrubs - wild rose, lilac, jasmine. All of them use for greening streets, walkways, courtyards.

There are more than 200 species of the herbs growing in floodplain and dry meadows near the Dnieper river. Grasses dominate in such kind of meadows: foxtail,

bluegrass, meadow timothy, fescue. Dry meadows are inhabited by tardus, cynosurus, buttercup, lady's mantle, prunella, cornflower, rattle, yarrow and others.

Mogilev and the surrounding area is inhabited by 200 species of vertebrates, of which more than 25 mammals, 100 breeding birds, more than 20 fish, 8 amphibians, 3 species of reptiles and more than 300 species of invertebrates.

1.4.1.2 Social and economic conditions

Tab. 1.4.1: Demographic and social conditions of Mogilev city*

Indicators	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**
Demographic situation						
Population	356 370	360 918	363 363	366 839	370 690	374 655
From it (in %):						
Under working age	15,8	15,2	15,4	15,7	16,0	16,2
In working age	66,7	64,6	63,9	63,1	62,4	61,7
Over working age	17,5	20,2	20,7	21,2	21,6	22,1
Birth rate per 1 000	8,9	10,9	11,2	11,9	11,9	12,3
Dearth rate per 1 000	10,5	11,0	11,2	10,1	10,4	10,0
Rate of natural increase (decrease) per 1 000	-1,6	-0,1	–	1,8	1,5	2,3
Registered unemployment rate, in% of the economically active population	1,7	0,8	0,6	0,6	0,5	0,8
Incomes and social conditions						
Nominal monthly salary, ths bel. rub.	480,7	1 189,9	1 842,2	3 553,8	4 874,1	5 890,7
Housing provision, m^2 total area per 1 person	19,9	21,3	21,6	21,7	21,8	21,9
Number of schools	53	55	56	58	57	57
Number of schoolchildren (ths per)	42,8	34,5	33,9	34,0	34,7	35,7
Number of doctors per 10 000		40,0	42,6	44,0	44,4	45,3
Number hospital beds per 10 000	142,2	152,2	151,6	150,1	107,5	105,6
Number of criminal incidents		3 923	3 597	2 604	2 608	2 634

* (Regions of Belarus, 2015)

Tab. 1.4.2: Demographic and social conditions in Mogilev district*

Indicators	2005	2010	2011	2012	2013	2014
Demographic situation						
Population	44 268	41 910	41 099	40 571	40 120	40 181
From it (in %):						
Under working age	15,6	15,2	15,6	16,1	16,6	16,8
In working age	57,4	57,6	56,8	55,7	54,9	54,0
Over working age	27,0	27,2	27,6	28,2	28,5	29,2
Birth rate per 1 000	9,5	11,6	12,6	13,5	13,4	13,5
Dearth rate per 1 000	22,4	21,4	23,2	18,7	18,7	18,2
Rate of natural increase (decrease) per 1 000	-12,9	-9,8	-10,6	-5,2	-5,3	-4,7
Registered unemployment rate, in% of the economically active population	1,0	0,6	0,5	0,5	0,2	0,2
Incomes and social conditions						
Nominal monthly salary, ths bel rub	381,7	1 023,4	1 605,2	3 147,3	4 557,3	5 659,1
Housing provision, m^2 total area per 1 person	31,9	34,4	35,3	35,9	35,1	35,7
Number of schools	31	27	25	22	22	20
Number of schoolchildren (ths per)	4,3	3,2	3,2	3,1	3,1	3,2
Number of doctors per 10 000		40,0	42,6	44,0	44,4	45,3
Number of hospitals beds per 10 000	142,2	152,2	151,6	150,1	107,5	105,6
Number of criminal incidents		782	874	641	657	600

* (Regions of Belarus, 2015)

Economic situation is shown in the Tab. 1.4.3 (Mogilev city) and Tab. 1.4.4 (Mogilev district).

Tab. 1.4.3: Economic situation in Mogilev city*

Indicators	2005	2010	2011	2012	2013	2014
Number of organizations	2 253	4 716	4 790	4 821	5 077	5 138
From it: SME	1 577	3 568	3 612	3 980	4 212	4 249
Industry						
Number of industrial organizations		533	525	538	568	377
Volume of industrial production, bn bel. rub.	2 216,7	6 452,2	12 402,0	22 069,7	24 313,4	26 711,4

In % to previous year	113,6	124,6	108,2	106,7	77,4	96,9
Share in region, %	44,4	42,0	40,9	38,0	40,2	44,3
Main products of city						
Sausage, ths tons	10,9	15,7	15,1	13,5	12,5	11,6
Milk production, ths tons	49,4	73,6	77,6	79,6	88,6	73,1
Fabrics from synthetic fibers, mln m^2	32,8	31,2	35,0	39,9	43,5	38,3
Chemicals, ths tons	157,5	214,6	209,4	185,7	167,2	155,7
Synthetic fibers, ths tons	91,1	89,8	88,3	86,4	72,7	61,4
Lifts and elevators , items	4 587	8 441	9 050	9 856	10 439	11 000
Electric motors, ths items	259,0	385,9	432,2	412,7	461,5	411,3
Trade						
Retail trade turnover						
In bn bel. rub	892,7	2 612,6	4 520,0	8 003,7	10 582,2	12 212,1
In % to previous year	…	120,4	112,7	116,5	117,8	104,4
Share in region, %	37,7	40,9	42,5	42,3	42,8	42,9
Export of products, mln $	480,2	835,4	1 003,9	1 183,0	1 209,7	1 182,8
Share in region, %	54,82	49,62	47,26	48,40	48,97	52,68
Export of services, mln $	11,9	28,3	40,1	46,7	69,8	71,5
Share in region, %	75,76	70,55	71,08	67,20	73,43	72,30
Finances						
Revenues from sales, bn. bel. rub.	4 280,9	16 545,6	29 402,9	49 704,8	59 248,5	60 467,7
Net profit, loss (-) organizations, bn. rub.	94,6	366,9	541,1	1 803,7	1 377,5	983,1
Return on sales,%	4,5	4,3	6,0	5,9	5,0	4,1
Share of unprofitable organizations,% of total number of organizations	21,6	18,8	18,6	16,1	17,3	18,1
Investments						
Investments in fixed assets, bn. bel. rub.	437,0	1 239,3	2 090,4	2 793,0	4 348,5	7 804,3
Share in region, %	34,2	22,1	18,3	16,5	24,9	40,7

* (Regions of Belarus, 2015)

Tab. 1.4.4: Economic situation in Mogilev district*

Indicators	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**
Number of organizations	186	508	601	715	987	1 004
From it: SME	78	393	476	592	852	882
Industry						
Number of industrial organizations		88	105	117	146	102
Volume of industrial production, bn bel. rubles	167,2	531,2	956,2	2 213,4	2 984,4	4 269,4
In % to previous year	105,4	121,4	104,5	134,2	129,8	258,2
Share in region, %	3,4	3,5	3,2	3,8	4,9	7,1
Main products						
Meat production, ths tons	16,6	32,5	38,1	47,6	62,7	69,8
Feed additives and feed for farm animals, ths tons	58,1	79,7	47,1	70,6	86,0	70,8
Soft drinks, ths dal.	3 885	1 829	1 197	531	567	574
Nonwoven materials and products, ths m^2	9 989	15 873	19 150	20 232	13 287	5 377
Agriculture						
Cultivated area of agricultural crops, ha	63 252	64 062	64 865	64 550	64 503	64 610
The total harvest of agricultural crops, tons						
Cereals	80 843	101 444	125 437	125 316	111 702	149 500
Potato	10 477	11 946	18 700	15 397	16 724	16 052
Vegetables	13 332	14 464	19 803	16 941	15 602	14 214
Flax	240	42	42	45	33	48
Yield, centers per 1 ha						
Cereals	30,1	35,8	43,2	43,8	38,9	51,1
Potato	135	158	222	184	247	217
Vegetables	196	170	207	192	337	282
Flax	6,6	8,4	8,4	9,0	6,6	9,6
Livestock, ths. heads						
cattle	41,5	46,4	47,6	48,9	46,9	46,6
including cows	13,1	13,9	14,0	14,3	14,0	14,0
pigs	56,3	73,5	73,2	75,4	70,5	67,5
Production of main livestock products						
livestock and poultry for slaughter (live weight), ths.t	27,8	51,9	60,0	76,6	86,0	101,3
milk production, ths. tons	52,0	72,9	75,4	74,9	71,4	66,2
egg production, mln. pcs.	152,3	170,0	183,5	199,2	180,5	138,1
Trade						

Retail trade turnover						
In bn bel. rubles	70,2	123,3	215,3	406,0	530,6	618,0
In % to previous year	…	125,1	113,7	115,7	110,6	103,3
Share in region, %	3,0	1,9	2,0	2,2	2,2	2,2
Export of products, ths $	9 348,6	18 766,9	30 680,1	39 297,6	88 243,3	149 490,5
Share in region, %	1,07	1,11	1,44	1,61	3,57	6,66
Export of services, ths $	346,9	1 885,2	1 279,9	1 564,5	4 956,5	6 344,1
Share in region, %	2,20	4,70	2,27	2,25	5,21	6,42
Finances						
Revenues from sales, bn. rub.	553,0	1 915,9	3 382,8	6 257,8	8 116,9	9 999,6
Net profit, loss (-) of organizations bn. rub.	19,9	99,9	292,7	372,3	-11,2	69,1
Return on sales,%	3,2	5,5	8,3	6,4	2,8	4,8
The share of unprofitable organizations, %	13,2	15,5	13,1	14,1	19,9	22,1
Investments						
Investments in fixed assets, bn. rub.	66,8	324,4	656,4	1 617,0	1 515,2	1 029,1
Share in region, %	5,2	5,8	5,8	9,6	8,7	5,4

* (Regions of Belarus, 2015)

1.4.2 Regional legal and institutional framework of waste management

Only national-level authorities and regional councils of deputies have the right on legislative initiative. Self-governmental bodies at the local level must comply with the approved at the national level documents.

At the regional and local levels there are several main documents in the field of solid waste management:

- “Norms” of MSW generation. For Mogilev city they were approved in 2001; for Mogilev district - in 2015. “Norms” take into account waste generation in improved and un-improved housing areas based on seasonal fluctuations. “Norms” are generally received by calculation and define the upper level of the amount of generated waste. The document is important in obtaining a permit to landfill a certain amount of solid waste at the territorial offices of MNREP and in the calculation of the environmental tax;

- Solid waste treatment scheme. It is approved by local self-government, establishes the procedure how to deal with MSW: the temporary storage places of MSW, and the frequency of collection, set up routes of MSW collection, the number and types of containers, etc.;

- Regional and city (district) program for the collection of recyclables. It is developed annually and based on the national program; approved by the local authorities. It provides indicators to update equipment of HPU organizations, measures to ensure the implementation of the national program performance in terms of separate waste collection and the collection of recyclables.

Institutional interactions at local and regional level in the field of MSW management are varied and quite confusing (Fig. 1.4.1).

We united all MSW generators in one group. It is clear that it is the most diverse stakeholder group because it includes residents, cooperatives and organizations with different forms of ownership and subordination. Arrows of submission we did not depicted due to the diversity of group. Interests of this group focus on the clean environment, and such cleaning should not be at their expense. These actors do not want to see how tariffs are growing. Local media and NGOs are the part of this stakeholder group. NGOs and mass-media have more opportunities from the point of view of interests' promotion, because they can communicate to governmental agencies and local authorities more productively and their demand usually is met. Mass-media and NGOs have a certain independence, the scope of which is determined by the national political climate. Waste generators link closely with SAE (or Zhilkomhoz in Mogilev district), and collecting points for recyclables, as well as local authorities (in the process of complaints) and the regional office of MNREP (in the process of litigation who blames, the issuance of licenses and permits), BelSRC "Ecology" (in the process of filing statistic data, if any).

SAE (with ZUBR), Zhilkomhoz have dual subordination - (1) sectoral – to MHPU; and (2) the territorial – to Mogilev city executive committee. SAE, ZUBR, Zhilkomhoz interact with BelSRC "Ecology" (providing statistic data), City Inspectorate and Regional Office of MNREP (in the explanation of the relationship who blames and what should be done), the Operator of recyclables (in the report on the implementation of State programs and the State order). As commercial companies, the interests of these players revolve around profit and ensuring the profitability. They are interested in rising of tariffs. Mentioned companies have a lack of financing, that why they are limited in new project implementation; and they desire investments.

Key players are Regional executive committee and City executive committee at the regional and local levels respectively. They have special departments of HPU which are in charge for MSW management, adoption of programs and plans in this field and control of their implementation.

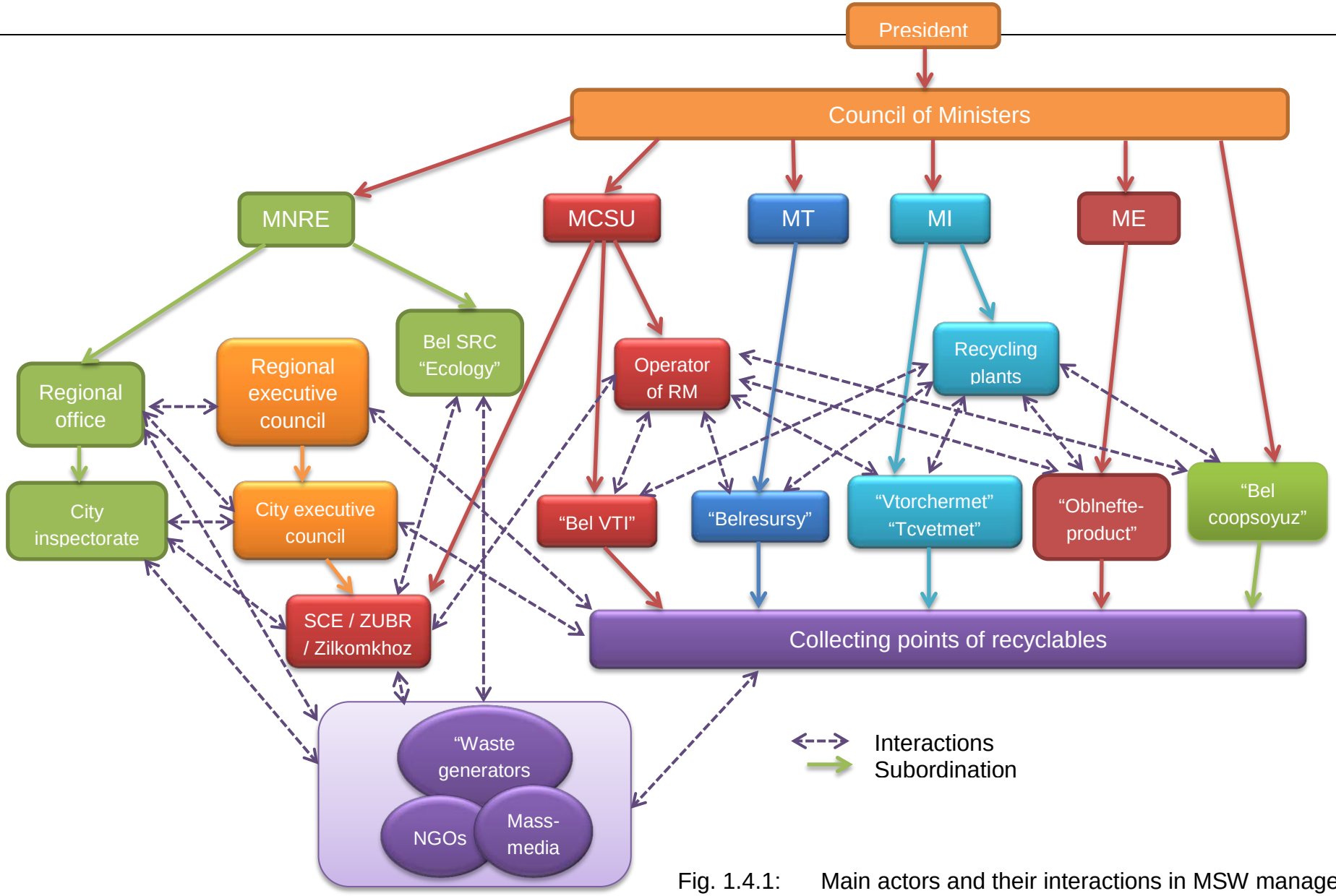

Fig. 1.4.1: Main actors and their interactions in MSW management

They link to all local and regional players; but their interconnections are quite complicate to depict, so in the Fig. 1.4.1 we drawn only relations with collecting points for recyclables (they are accountable before executive committees for recyclables collection under State program and State order; but, of course, they send reports in behalf of the parent organizations). Interests of Regional and City executive committees focus on organization of recyclables collection and full implementation of State programs and State order. They have vested interest in investments because a number of measures are carried out at the expense of local budgets; and because they usually have a lack of financing and lack of independence in searching investments. In spite on mentioned strong interests in the improving of MSW management, representatives of this stakeholder group do not like to take responsibility and make decisions, that why project implementation (even at the expense of third side) takes ages.

The most complicate story is story about recyclables. Collecting points for recyclables belong to different organizations (i.e. “Bel VTI”, “Belresursy”, “Vtrocherment”, “Beltsvrtmet”, “Oblneftrproduct” and “Belcoopcoyuz”) which are have different subordination (see Fig. 1.4.1): MHPU, MT, MI, ME and Council of Ministers (respectively). Except “Vtrocherment” and “Beltsvrtmet”, mentioned organizations do not recycle by own, and only collect, pack and deliver recyclables to recycling plants (which are subordinated by different departments of Ministry of Industry, depending on the type of SRM). In addition, a lot of different organizations subordinated by different Ministries interconnect with Operator of recyclables in the implementation of State program and State order. In fact, in such situation no one is accountable to no one, so it is impossible to find necessary data easily.

Stakeholder group of collecting points is interested in the rate of profit, it is crucial for them that the purchase prices for residents will be as low as possible, while sales prices for collected recyclables will be as high as possible. But so far State programs and State order allow do not care about full collection of recyclables from people (now implementation of State program and State order is possible by legal entities), so major changes in work of this stakeholder group are not visible on the horizon. It is strong feeling that they will have to change their marketing strategies, but could not be yet said when it happens. Recycling plants are very interested in stable providing the required amount of SRM at reasonable prices. Perhaps it is a reason of their active participation in the development of programs for practical implementation of EPR principle. But development of programs is stuck due to the economic crisis.

National players – all Ministries, Council of Ministers and President – are interested in the full implementation of all normative regulations and requirements, procedures and control measures. Of course, this stakeholder group plays a huge role in MSW management in the field of establishing rules; but at regional and local levels their function is coordination of other players.

The scheme in Fig. 1.4.1 does not include the police and the courts, which are actively intervened in the illegal traffic of recyclables, Department on statistic data, Sanitary and epidemiological services and a couple other minor actors, but actually for

the general understanding of the institutional interactions in the field of MSW management their description is not necessary.

All noted above allows concluding that institutional interactions in the sphere of MSW management have:

- overlapping control functions of different institutions; the lack of transparency in powers of different institutions; mismatch between institutions and area of their operation; mismatch between power of institutions and problem scale which should be solved; imperfection of the interaction mechanism between institutions (institutional gap of governance);

- lack of transparency in procedures of power distribution; the inertness of the community and local authority, failure to bring all of its members to fulfill the general obligations (the gap in the monitoring and enforcement of the requirements).

1.4.3 Development of waste management situation and infrastructure

Scheme of solid waste management at Mogilev city and Mogilev district is represented in the Fig. 1.4.2. Let's consider the fate of the waste generated by citizens. It should be noted that the fate of recyclables and municipal waste is somewhat different. Therefore, we will have first look at what happens with the municipal waste (generation, collection, transportation, sorting, treatment and landfilling), including illegal dumping and littering environment. And after that we will have look at the life cycle of recycled waste from the moment of generation to their processing, including illegal activities in this area.

Municipal waste

MSW generation

Statistic data equals the total amount of generated waste with the total amount of collected waste, and, as a rule, these figures indicate also the amount of landfilled waste (as all three mentioned indicators are based on data from landfills annually provided to BelSRC "Ecology"). SRM are generally accounted separately and they are not included in the total amount of generated waste (in accordance with Belarusian legislation, recyclables are not waste). This approach to the management of statistics does not allow estimating the actual number of generated waste, especially in regards to the garbage, thrown into the environment or stored and (or) landfilled in illegal dumps.

There are several sources of solid waste generation (multi-story apartments; private households; garage cooperatives; garden cooperatives; organizations and plants. The total amount of solid waste in Mogilev region, Mogilev city and Mogilev district is increasing (Fig. 1.4.3).

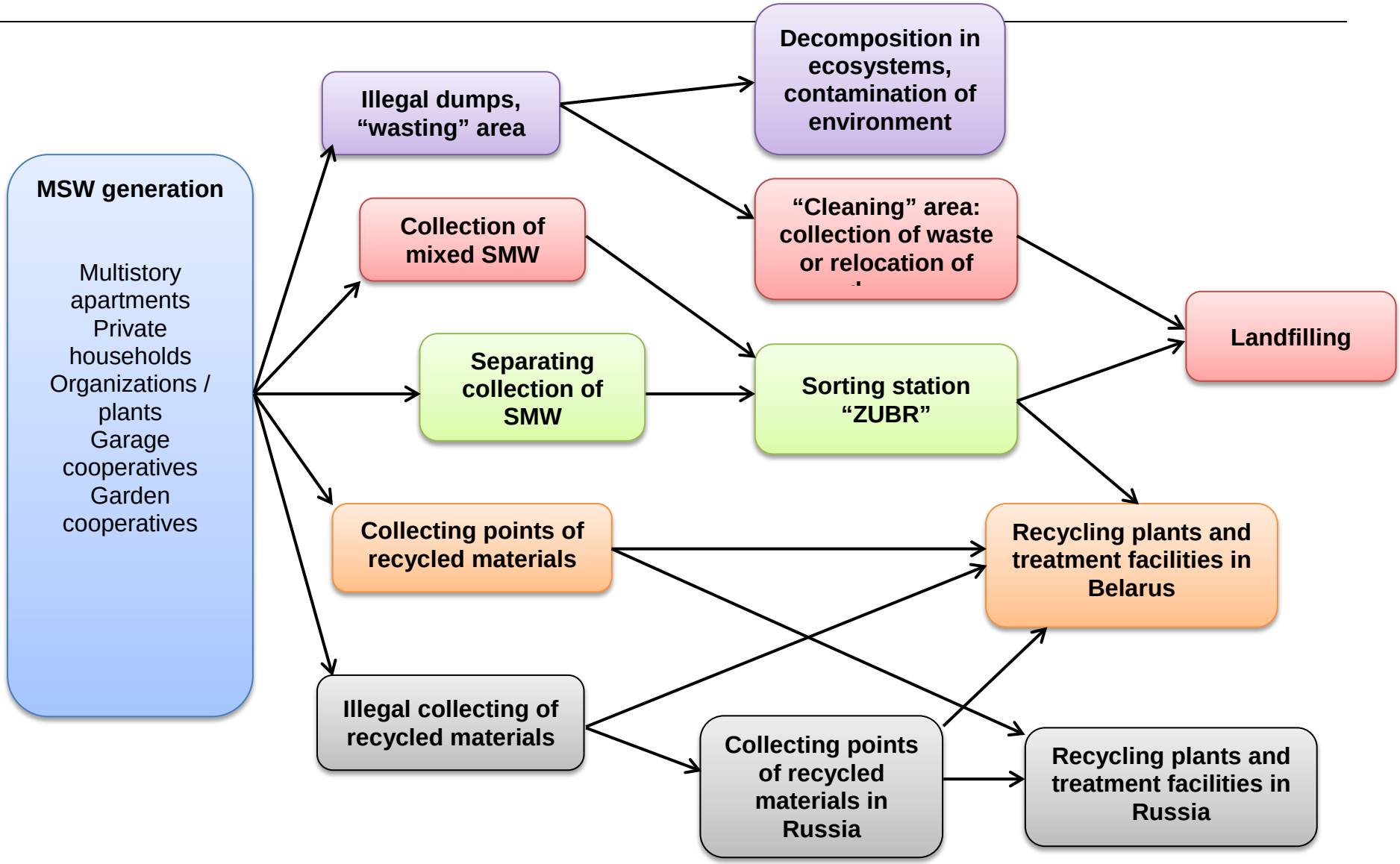

Fig. 1.4.2: Scheme of MSW management in Mogilev city and Mogilev district

If we take into account the fact, that the population of Mogilev region and Mogilev district is decreasing, the speed of growth of MSW generation looks threatening. By the number of generated waste per capita, Mogilev region, Mogilev city and Mogilev district are close to the European level of economically developed countries (Fig. 1.4.4). The graphs in Fig. 1.4.3 and 1.4.4 are based on data of RD HPU and may differ from the official statistic data. In Mogilev district data is provided only from 2008. Regional data is slightly lower till 2012 because not all districts had provided statistics on generation, collection and disposal of waste. Local authority could not give clear explanations of reasons of data missing during interviews.

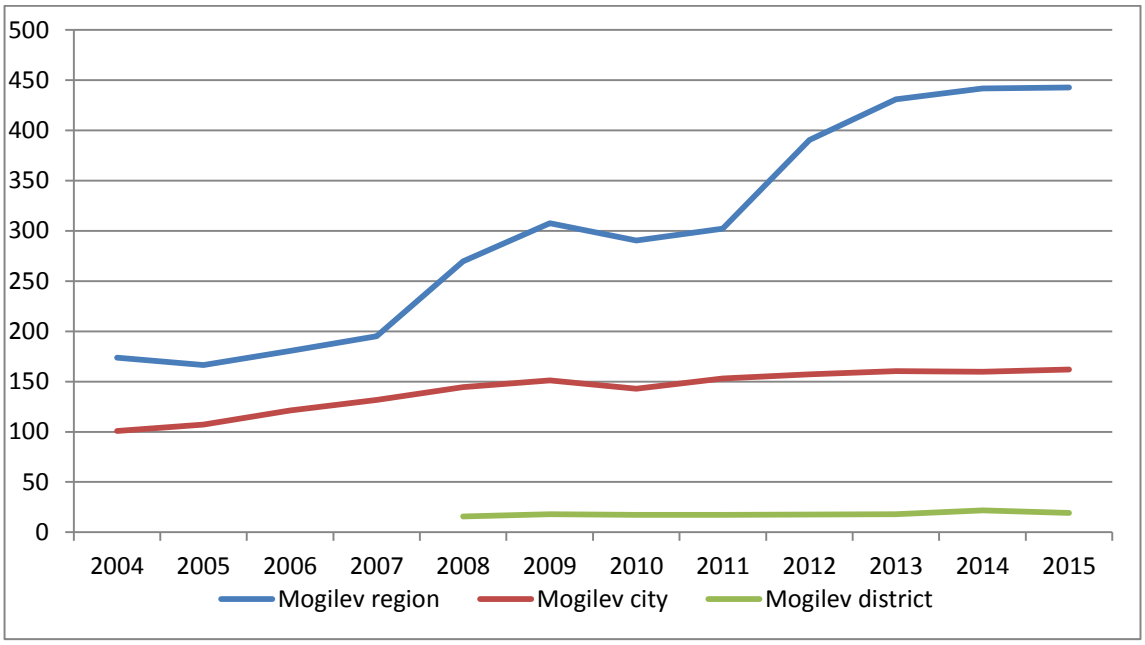

Fig. 1.4.3: Total amount of waste generation in Mogilev city and Mogilev district, ths t
(based on the data of RD of HPU)

Illegal waste generation. In our case, under illegal waste generation we understand the accumulation of MSW in natural ecosystems either in bulk or in the form of illegal dumps. In spite of the lack official estimations of litter area and the amount of garbage at illegal dumps, we can make the following qualitative conclusions:

- littering is happening at recreational areas in the city and in the suburbs. Rubbish is accumulated near the favorite/ organized picnic places. The trash composes of plastic (dishes, bottles, packaging), glass (bottles), paper (napkins, wrapping). MUE “Zelenstroy” is in charge to clean up recreational areas in city, Forestry departments are in charge for suburbs. They, of course, clean up littered areas, but they do not have enough capacity to support this duty fully. All collected litter is transported to the landfill (through the sorting station, when we speak about Mogilev).

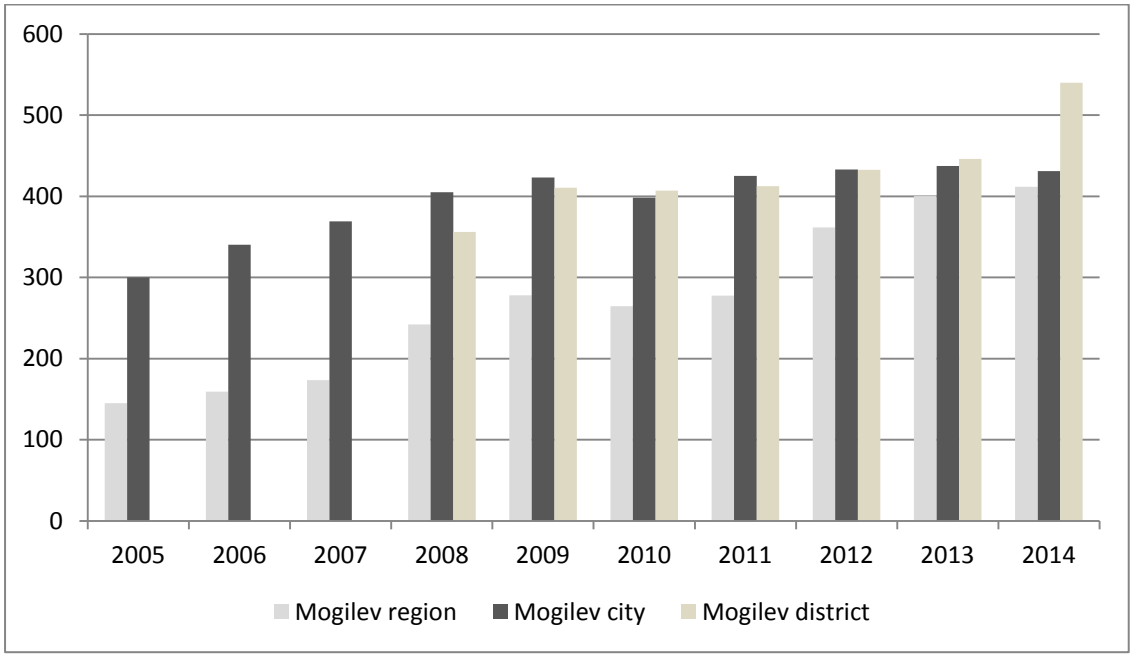

Fig. 1.4.4: MSW generation, kg per capita per year
(based on the data of RD of HPU)

- Illegal landfills and dumps is spontaneously generated in the bushes, thickets and forests adjacent to the private housing area in the city, summer housing areas, garage cooperatives and rural settlements. Waste consists of the waste which (1) is not accepted by SAE or Zhilkomhoz (construction waste, SRM, which are not accepted by collecting points for recyclables), (2) household waste (households do not have agreement with SAE). MNREP is in charge for control and monitoring of such dumps, but it is needed to "catch hand" for starting administrative procedure to punish polluter. This is impossible in most cases; therefore, illegal dumps are virtually unchallenged. Local and regional offices of MNREP after the detection of illegal dump give an “order” to owner of dump or (more often) to local department of HPU to remove dump. Waste is transported to official city (or district) landfill.

- roadside littering of highways. The main source of littering is waste from the passengers and drivers. Transport companies are in charge for cleaning, removal and landfilling of such waste.

According to words of representatives of RD HPU and local and regional offices of MNREP, every rural settlement has at least one illegal dump; and bushes adjacent to housing are littered with household waste. However, responsible persons do not provide any number and amounts of illegal dumps. According to words of officials from City inspectorate of MNREP, area of private households in Mogilev city is a real headache in regards to illegal dumping. Processes of their generation and growth is monitoring, controlling and punishing, removing and etc., citizens have opportunity to complain City executive committee (at web-site, by phone or personal meeting), but fundamentally the problem is not been solved.

MSW collection

MSW collection is carrying out by 2 possible ways, which are depended on source of waste generation as well as the place of temporary storage of waste:

- “container use” – implemented at multi-story housing area;
- “yard detour” – implemented at private households area and rural settlements.

“Container use” approach. Waste collection and accumulation at multi-story housing areas is carried out at special sites where containers are installed (example of such site is shown in Fig. 1.4.5). Waste chutes in multi-story building are closing step by step in Mogilev city. In 2015 it was stopped 77 waste chutes in 24 houses (data of RD HPU). It is strong official belief, that this measure promotes separate waste collection and helps to improve sanitary condition of houses. But not all citizens would like to share the official point of view. For example (data of RD HPU), at this moment there are a few complaints from citizens disagreed with resolution to close of waste chutes at RD of HPU. Closure of waste chutes is impossible without the consent of the owners (or tenants) of residential apartments, which is the main reason that in Mogilev city waste chutes are still existing.

Tenants are in charge to remove the waste to container site by own hands. The local HPU sites service container area, but their workers can not monitor constantly who and how deals with MSW. At the containers sites special containers for separate MSW collection are installed (for plastic – everywhere, for paper - in some cases, and for metals or glass – very rarely). At least 1 installed container for separate collection of plastic is enough to state (by RD of HPU) that the separate collection of MSW is organized. That why according to data of RD HPU, separate collection of MSW covers 85 % of urban population and 30 % - of rural population in region.

According to Belarusian legislation, service companies (in our case, local HPU sites) must provide conditions for the separate collection of MSW. In the case when such conditions are not provided, the tenants are not required to collect the waste separately and can throw it like mixed waste.

It, in fact, explains the low level of coverage by separate MSW collection in rural areas and urban private households area: as a rule, there is a lack of specially equipped sites for waste collection and temporary storage at such areas, that why residents collect waste in the way fitted to them; and official statistic data does not consider such collection as separate.

Data on waste bines (2016) in Mogilev city and Mogilev district is shown in the Tab. 1.4.5.

Organizations and business bodies should sign contracts on MSW removal with SAE. Organizations and business bodies are also obliged to ensure separate waste collection and do not admit removal recyclables and hazardous waste to the landfill. In 2015 they were 388 administrative punishing cases for landfilling of recyclables with total sum 625,0 million rubles in relation to legal entities (data of RD HPU). Each year, organizations are required to conduct an inventory of waste and to take a special

license in the local and regional offices of MNREP. The license is included the list of generated kinds of waste (in accordance with the Classifier) and their limited amounts are allowed for landfilling. Usually such kind of list includes not only MSW.

Fig. 1.4.5: Container site for MSW collection and temporary storage at multi-story housing area

Tab. 1.4.5: Bins for temporary storage of MSW (2016)*

Region	Type of waste	Number of bins	Bin capacity	Bin material
Mogilev city	**Mix waste**	**2247**	**In total**	
		1858	0,75 m^3	Metal
		220	1,1 m^3	Metal
		150	360 l	Plastic
	Special containers	7	8-36 m^3	Metal
	mulilifts	12	8 m^3	Metal
	Separate fractions:	**1822**	**In total**	
	Paper and cardboard	445	1,1 m^3	Metal
	Glass	751	1,5 m^3	Metal
	Plastic	626	1,1 m^3	Metal
Mogilev district	Mix waste	426	0,75 m^3	Metal
	Separate fractions:	**483**	**In total**	**Metal**
	Paper and cardboard	89	0,75 m^3	Metal
	Glass	234	0,75 m^3	Metal
	Plastic	160	0,75 m^3	Metal

* data of RD of HPU

"Yard detour" approach. MSW collection at urban private households areas and rural areas are carrying out by residents themselves and based on signed agreement with SAE (it is touch summer houses areas, garden and garage cooperatives). As a

rule, residents in special day for MSW collection must put boxes / bags with waste near road. After that they are collected by tractors with trailers owned to SAE or Zhilkomhoz (Fig. 1.4.6).

Fig. 1.4.6: "Yard detour" approach to waste collection in rural area (http://www.kirovsk.by/2015/03/zaklyuchat-dogovora-na-vyvoz-musora-obyazatelno/)

Urban citizens have an additional option for the separate collection of waste in places of its generation: SAE provides transport (according to request of local HPU sites or tenants) for the removal of specific types of waste such as bulky waste or construction waste, which by law can not be disposed in the container, but everybody does it. In addition, SAE can send a car to collect waste paper and glass (or any recyclables). However, local HPU sites and public rarely use this option (may be, they (1) do not know or (2) do not wish or (3) do not have money). It is not clear, who should pay for waste removal in the case of request from local HPU sites. In the case of residents' request fee should paid by the tenant. So, for tenants this option is very expensive, that why much easier for them to take out trash to the container under the cover of night, or to put waste near container and hope that somebody is needed in this trash.

MSW transportation and sorting

Waste transportation is carrying out:

- from container sites / private households / organizations to the sorting / storage / treatment places by transport of SAE (Zhilkomhoz) in accordance with the established schedule of MSW collection. Every day in Mogilev city special cars collect MSW on 12 routes in the Oktyabrsky district and on 17 routs in Leninsky district. In addition, special cars collect MSW on 12 routes in the urban private household area.

- from residents / organizations to collecting points for recyclables – by resident's / organizations' transport;

- from collecting points for recyclables to processing enterprises - by transport of processing enterprises or companies for collection of recyclables.

In Mogilev city all MSW goes to ZUBR, in Mogilev district – to landfills directly (mostly) and very small amount of MSW goes to ZUBR. Actually, Mogilev district does not collect recyclables according to data of RD HPU.

ZUBR is a sorting station (so far is a part of SAE, but there is plan to stand out in a separate legal entity in next 1-2 years). ZUBR started to work in 2009. There are 2 sorting lines at ZUBR. The second line was launched in 2014. Total capacity of 2 lines is 90 000 tons, which is enough (according to words of RD HBU and CD HPU) to sort out 100 % of MSW generated by Mogilev population. Data about waste composition is shown in the Tab. 1.4.6. Data was provided by representatives of SAE; information differs from official statistic.

Tab. 1.4.6: MSW composition*

Component	MSW in containers of multi-story housing area	MSW in private household area
Glass	7,5	7,0
Polymers, including:	2,8	1,1
- PET-bottles	0,8	0,7
- plastic package	2,0	0,4
Polyethylene	0,3	1,7
Waste paper and cardboard	8,4	1,4
Ferrous metals	1,7	1,2
Non-ferrous metals	0,01	0,03
Textile	0,9	2,1
Wood waste	4,6	0,21
Construction waste	11,3	3,1
Organic waste	39,6	0,6
Surface waste	6,0	1,02
Other waste can not be recycled, incl.:	16,9	1,8
- rubber	7,8	0,78
- shoes	9,1	1,02
Containing recyclables	21,65	14,54
TOTAL	100	100

* data of SAE

Every day mixed waste is transported to ZUBR from around the city. Recyclables from special containers and collecting points are transported to ZUBR too. In the case of recyclables, sorting is not launched.

Special car goes to reception point (Fig. 1.4.7) and unloads mixed MSW. Immediately MSW goes to sorting line (Fig. 1.4.8), and after that – to sorting department. Before sorting, MSW goes through “breaker of packages”. Packages, by the way, are not taken away, but sorted. Then MSW goes to separator, which is sifted waste: heavy waste (metal or cardboard) is sediment, organic waste goes to special container (it was production of compost previously, but now organic waste is landfilled). Remains after separator move to sorting line, where waste is separating by hands (Fig. 1.4.9). 38 persons (mainly women) are working simultaneously at soring line. They are provided with rubber gloves and respirators.

Fig. 1.4.7: Reception point for mix waste at ZUBR
(http://gorad.by/by/page/town/6879)

Fig. 1.4.8: Sorting line at ZUBR
(http://www.kp.by/daily/26277/3154701/)

Polyethylene, PET-bottles, paper, cardboard, glass, metals are extracted from MSW. Sorting workers select everything which could be recycled. Remains go over the line on and fall into special container where waste is compressed and then is transported to landfill. Sorted recyclables are packaged and sold to other companies. For example, the paper is pressed by special press and sent to paper factory in Shklov, and glass is crushed into pieces and taken on "Belresursy"; polyethylene film is milled into dust, is poured into the extruder, which makes pellets; metal is transported to "Mogilëvvtorchermet" and etc.

Fig. 1.4.9: Process of waste sorting at ZUBR
(http://gorad.by/by/page/town/6879)

73,0 ths tons of mixed waste was transported to ZUBR in 2015, after sorting was extracted 3,3 ths. tons of recyclables or 4,5 % from total waste. In addition, it should be noted, that ZUBR received 8,0 ths. tons of recycled materials from collecting points and special containers. Totally, ZUBR received 80,3 ths. tons of MSW, 10,6 ths. tons (or 13,2 %) of recyclables were extracted (Tab. 1.4.7).

Tab. 1.4.7: Extraction of recyclables at ZUBR*

Indicator	2014	2015
Amount of sorting MSW (in fact), tons	47717	80323
Daily capacity, tons per day	143	256
Sorted recyclables, tons	7321	10480
Share, %	15	13

* data of SAE

As you can see, sorting station is unprofitable and disadvantageous business. ZUBR should somehow increase the share of extracted recyclables. Figures say that increasing extraction is possible only with better waste separation at the places of MSW generation and / or temporary storage. At the same time, all representatives of SAE and ZUBR say that separate collection at the place of waste generation and temporary storage is a trouble-making business, cost are much larger than profit, and may be much easier to give up it and separate all mixed waste at the sorting station.

There are no sorting lines in Mogilev district at present. Representatives of RD of HPU said that 1 sorting line was bought in 2015, but it is not still installed. They hope that the sorting line will be installed during 2016 in Golynets village dump.

Treatment / storage / landfilling of MSW

Landfill is the main way of "treatment" of MSW. There are no incineration, composting and biogas production plants in Mogilev city and Mogilev district at present. Even more, it is not expected that such plants will be constructed in the near future, because all economic background calculations show the unprofitability of construction (by the words of SAE and ZUBR). Representatives of SAE said that they have calculated the construction of incineration plant and concluded that while tariffs for removal and landfilling of MSW will remain at the same low level, the waste incineration is not economically feasible.

There are some ridiculous stories about treatment facilities. For example, about 5 years ago it was great idea to produce compost with financial support of international project. Worms died in 2 years due to very high soil contamination by heavy metals. The idea never came back. Firstly, we need to collect batteries and mercury-contained lamps separately, and may be after that we could come back to composting.

City dumped all its waste to only landfill - Mogilev landfill. Mogilev landfill is located in 20 km to south from the city, in the direction of the highway Mogilev-Gomel, in 2,7 km to the north-west from the village New Mileevka and in 2,8 km to the south-east from the settlement Mirhyj. The Lazeevka river flows in 3,2 km to the south-east from the landfill. The size of the sanitary protection zone is 500 m along the perimeter of the landfill. Sanitary protection zone is occupied by forests from the west and north, and arable lands from the east. The nearest water source is located in the village New Mileevka in 3,3 km from the landfill site.

Land for the site was selected according to decision of the Mogilev regional executive committee in 2001 (landfill was in operation since 1982, but in 2001 the special procedure according to new Land Code was carried out, and official document on land spot ownership was re-approved). Additional space has been added for the second stage of the landfill according to decision of the Mogilev Regional Executive Committee in 2006. Total landfill area is 19,6097 hectares, working area is 12,54 hectares, and consists of two “stages”. Currently, the first stage is completely filled; the first starting spot of the second stage is filling now. Accumulated waste is around of 930

ths. m^3, the design capacity of the landfill is 1104,229 m^3. The annual volume of landfilled waste is about 837 ths. m^3 (214,6 ths. tons), including the waste from population is about 556,9 ths m^3 (139,2 ths. tons) and from organizations and enterprises is about 280 ths m^3 (75,4 ths. tons). Mentioned above figures were provided by SAE according to Environmental passport of Mogilev landfill. Representative of SAE said that figures in the reality are quite different from data in Passport, because real data doesn't allow receiving permission from Regional committee of MNREP, that why numbers were "a little bit" corrected. The capacity of the landfill will be enough for next 5 years. And after that the issue – where landfilling MSW of Mogilev city – will become very actual and solving-complicated problem.

The landfill is equipped with the following facilities for environment protection: circular channel around the landfill, partial dam around landfill, protective screen (partly – clay, and partly – film).

Landfill is a part of glacial-fluvial plain. Geological deposits are lacustrine and swamp faces of Holocene age (sandy loam + peat). Glaciofluvial deposits of Sozh age lie below (sandy loams and sands). At the base of the section moraines of Sozh age locate (sandy loam and loam with inclusions of pebbles and gravel).

Ground waters lie at a depth of 0,2-1,8 m. The direction of the underground water flow is the north-west. Groundwater monitoring is carried out at three observation wells located within 100 meters from the landfill border to the north, west and south sides. Ground waters are heavily polluted: maximum permissible concentration (MPC) is exceeded for iron, ammonia nitrogen, cadmium and petroleum products. The highest concentrations of pollutants were recorded in the well number 1 (on the western borders of the landfill), which is associated with the direction of groundwater flow, and the location of well in a lower part of the relief. In 2009, the concentration of mercury in the well number 2 was exceeded MPC by more than 100 times. Geochemical soil monitoring was conducted in 2008 and was fixed the exceeding of MPC of lead and cadmium.

In Mogilev district all waste is transported to the mini-landfills. Five years ago there were 368 mini-landfills. Today there is a program for reducing of mini-landfills which was developed by MHPU and MNREP together. The results of the program are great, according to the data of the RC of MNREP (Tab. 1.4.8). However, one can see that it is often a mini-landfill is closed only on paper, but in life it continues to function (for example, in Schezhar village). There are no sorting lines at the mini-landfills, no weights, no protective screens and no monitoring of the groundwater. It's a big lucky, if the mini-landfill has a fence. Typical view of mini-landfill you can see in Fig. 1.4.10. All our respondents said there is no data about amount of waste at mini-landfills. All estimations are made visually "by eye". Even more, there is no un-official data on mini-landfills. It seems quite ridiculous, but mini-landfills are not a point for local NGOs.

Tab. 1.4.8: Data on mini-dumps in Mogilev district and Mogilev region*

Territory	Amount of mini-landfills on 01.01.2015	Amount of mini-landfills on 01.01.2016	Amount of recultivated mini-landfills in 2015	Recultivation plan on 2016
Mogilev district	40	14	26	2
Mogilev region	274	145	129	22

* data of Regional committee of MNREP

Fig. 1.4.10: Mini-dump in Shchezhar village

(http://ont.by/news/our_news/kolichestvo-mini-poligonov-bitovih-othodov-na-mogilyovschine-planiryyut-sok)

Recyclables

Collection of SRM

Population and public organizations can deliver SRM for recycling to special collecting points in addition to using the aforementioned method of separate waste collection. The collection of SRM is licensed by governmental bodies. There are several organizations collected SRM from the people “Belkoopsoyuz”, “MHPU”, "Belresursy". The list of recycled materials is rather limited:

- metals, including lead-acid batteries;
- glass, paper, textiles;
- plastic;
- galvanic batteries;
- household appliances (WEEE);
- mercury-containing lamps.

Most collecting points provide services for collection of various types of SRM. There are no collecting points in the Mogilev district, but the information on the collection points in Mogilev city are shown in Tab. 1.4.9.

Tab. 1.4.9: Collecting points for recyclables in Mogilev city*

Type of the secondary material resources	**Number**	**Opening hours**
Wastepaper, container cullet, sheet cullet, textiles, batting, colorless and colored polyethylene film, PET-bottles for milk	19	7:30-16:00, Lunch 13:00-13:30. Day off — Saturday, Sunday.
Wastepaper, glass, PET-bottles, film, used tires, textile, black and non-ferrous scrap	6	8:00-16:30, Lunch 13:00-13:30, Day off — Saturday, Sunday.
Wastepaper, glass, PET-bottles, film, used tires	1	8:00-17:00, Lunch 13:00-14:00. Day off — Saturday, Sunday.
Wastepaper, glass, PET-bottles, film	3	8:00-16:30, Lunch 12:00-12:20. Day off — Saturday, Sunday.
Wastepaper, glass, PET-bottles	6	8:00-17:00, Lunch 13:00-14:00. Day off — Saturday, Sunday.
Wastepaper, PET-bottles	5	10:00-12:00, 14:00-16:00. Day off — Saturday, Sunday.
Glass, used tires	1	8:00-16:30, Lunch 12:00-12:20. Day off — Saturday, Sunday.
Wastepaper	3	10:00-12:00, 14:00-16:00, Day off — Saturday, Sunday.
Site for collection of bulk waste	1	7:30-16:00, Lunch 13:00-13:30. Day off — Saturday, Sunday.
Household appliances	1	Monday-Thursday – 8:00-17:00, Friday – 8:00-15.45, Lunch – 12:00-13:00. Day off — Saturday, Sunday.
IN TOTAL	**46**	

*web-site of Mogilev executive committee, http://mogilev.gov.by/ob-yavleniya-goroda/6275-8694-punkty-zagotovki-vtorichnogo-syrya-v-mogileve.html

The schedule is very uncomfortable for users, and if you would like to come there – you will probably not make it. Besides, prices are low. In general, the population does not have incentives to give away SRM voluntary. There are also mobile centers of SRM collection. But they only work well in countryside, not in the city.

Let's consider the features of turnover of certain types of SRM.

Metals turnover in Belarus is tightly controlled. Only a hint of illegal origin of handed metals may result in a call to the police and lead to huge penalty. See, for example, publications in mass media "Delivery scrap turned fine" (2014) http://lidanews.by/news/r1/so1/3525-sdacha- metalloloma-obernulas-shtrafom; "Passion and misfortunes on metal" (2011) http://www.mogved.by/kompetentno/3704 metal). The population is honestly warned about it at the collecting points (Fig. 1.4.11).

Fig. 1.4.11: Advertisement at scrap metal collecting point

(http://komkur.info/ekonomika/vtorichnoe-pervichno)

Translation: „Scrap metals from households are collected in accordance with approved list. In the case of detection of manholes, sewer gratings, rails, rail shoes police will be informed immediately. Administration".

Collecting points belong to "Vtorchermet" company (ferrous metals) and "Beltsvetmetally" company (non-ferrous metals), which both have offices in all regions of the country and in large cities. Lead-acid batteries can be taken by service stations and shops that selling them. There is a special reminder for the people on the web sites of the companies and at the collecting points: it says what could be received and how, as well as prices for organizations and people. The prices for the population are shown in Tab. 1.4.10. Metals are transported from the collecting points to the concerns plants for further recycling. Sometimes, collected metals are sold abroad, mainly in Russia (but after the State order is made). State order is so huge that almost all collected metals go at Belarusian metallurgical enterprises. By the way, the numbers and task on collection of metal scrap is given to all organizations. Every organization tries to do its best. For example, employment centers in the districts have an unwritten rule - citizen must bring a certain amount of waste paper and scrap metal to pass the registration as

unemployment person. Numbers depend on the district of Mogilev region and the tension of State order.

Tab. 1.4.10: Prices for scrap metals for population at collecting points (on 01.07.2016)*

Class of metal	*Group and characteristic of scrap and waste*	*Price excluding VAT in payments with individuals, rubles per 1 kg net*
Ferrous metals	Household steel scrap metal	1300
	Household cast-iron scrap metal	1500
	Household unsorted scrap metal	120
Aluminum	Household scrap of pure aluminum (undoped), is not clogged by other metals and alloys	15 600
	Household scrap of aluminum and its alloys, not clogged by other metals and alloys	13 700
	Household scrap of aluminum and its alloys, do not correspond to the requirements of grades 1 and 1a	13 100
	Household scrap of aluminum and its alloys, do not correspond to the requirements of grades 1, 1a and 2	10 500
Magnesium	Household scrap of magnesium and its alloys	15 400
Zinc	Household scrap of zinc and its alloys	10 200
Copper	Household scrap of copper, not clogged by other metals and alloys, without varnish, paint, insulation and firing traces	62 100
	Household scrap of brass, not clogged by other non-ferrous metals and alloys	37 800
	Household brass scrap, not clogged by other metals and alloys	44 300
	Household copper scrap, not clogged with other metals and alloys, does not meet the technical requirements of grade 1	50 200
	Household copper-containing scrap (copper, brass, bronze) of low quality, does not meet the technical requirements of grades 1, 2, 3, 4	28 500
	Household nickel-based scrap, its alloys and copper-nickel alloys, not clogged by other metals and alloys	74 100

	Household nickel scrap, nickel-based alloys and copper-nickel alloys of low quality that does not meet the technical requirements of grade 1	37 000
Lead	Household scrap of lead, tin and their alloys	18 300
Lead (lead-acid battery)	Household scrap of wasted not cutted lead-acid batteries	16 800

* web-sites of “Vtorchermet” http://bvm.by/ and “Beltsvetmetally” http://bcvm.by/zakupka-loma

Previously, collection of glass was carried out in every major grocery store. Today most of the centers are closed due to the low profitability. A facade of glass collecting points is presented in Fig. 1.4.12. The glass collection is also carried out under the State program and the State order, which is not very good for citizens: the centers do not accept all types of the glass, bottles of not-Belarusian producers can be taken only at the price of cullet, which is extremely disadvantageously. In addition, the bottles should be clean and free of paper stickers and labels, which lead to further reduces of customers. The main clientele of such centers are the homeless and alcoholics who seek out glass bottles around the city and in the trash containers to make some money and buy cheap alcohol and tobacco. Demand in waste glass has dropped sharply today: almost all glass factories are in a very difficult financial situation. For example, earlier the glass from Mogilev was transported to Elizovo for recycling. The factory in Elizovo went bankrupt last year and it is closed for now, so one has to look for the glass recycling company in Gomel or in Minsk region. The plant in Minsk region is very new; it even has a line sorted the broken glass by color.

Fig. 1.4.12: Glass collecting point
(http://www.ctv.by/pochemu-sdavat-steklotaru-v-belarusi-stalo-nevygodno-i-slozhno)

Situation with textile is even worse. Clothes can not be handed over; you can't deliver synthetic fabrics and so on. Therefore it is easier to throw away or burn old clothes than to find recycling points for it. Even ZUBR stopped receiving and sorting textile this year due to lack of economical inexpediency.

Paper and cardboard are accepted willingly with one condition: waste paper should be either tied or placed in bags or boxes. The paper is collected under State order and the State program. Public customers: Bellesbumprom (Puhovichi, Svetlogorsk), Public Corporation "BELGIPS", Public Corporation "Zelenogorsk", Shklov Paper Factory "Spartak". Almost all collected waste paper in the Mogilev region is transported to Shklov. Collection of plastic became profitable in recent years. Most residents throw out plastic waste in a special container near their homes. However, the homeless people collect and hand over the plastic. Mogilev enterprise "RePlas-M" recycles almost all plastic, dirty plastic is recycled in Krugloye (small town in Mogilev region).

Batteries are collected by residents voluntarily. In stores and organizations across the city special containers are installed (but not in the yards). Population is required to not throw out batteries together with other trash, but put it in a pocket and leave it in the container somewhere. This happens seldom enough: an absolute majority of the batteries gets straight to the dump together with mixed waste.

There was no place to collect household and office equipment and devices until this year. Individual consumers mostly were taken out the equipment to the containers for the collection of mixed waste or were just placing the waste near the containers. Now we have company "BelVTI" collected electronic waste, it also have the duty to collect the batteries. "BelVTI" is a republican enterprise with offices in each regional center. They do not have statistics even in six months because they started work not long ago. They take old equipment at the place of its location: they arrive to the office or to the private house or apartment. The commercial effect of such collection for people is a minimum, since the definition of electronic waste in the Belarusian legislation does not exist and the price of such waste is estimated by metals, which determines the lowest cost for each TV or refrigerator. The collection of electronic waste bases on environmental responsibility of the citizens, but practice shows that many residents are quite enthusiastic to see the new way how to keep clean their balconies and apartments from old devices and appliances. So "BelVTI" has a chance to succeed in the long term. In 2016 the largest operator of mobile connection "Velcom" initiated action on exchange old and broken sell-phones on services provided by company (mostly, free-from-payment time of conversation). All service centers of "Velcom" collect old and broken phones. People get rid enthusiastically of old phones (see http://42.tut.by/505559).

Another acute question is mercury-containing lamps. Previously, the people had to pay for the disposal of such lamps, and there was the only one option - to bring them directly in SAE located at the outskirts of the city without any public transport to get there. It is clear that no one used that option. The lamps were transported to the landfill

as a part of mixed waste. The City Inspectorate of MNREP and City Executive Committee have established the list of collecting points for the lamps in every HPU site this year. It is free of charge for the citizens today. But so far not much people know about this opportunity. This information is not presented even on the website of the City Executive Committee.

There are some plans to develop a network of points for receiving waste oil and used tires from the population. It is started already, but so far it is mostly work with organizations, not with citizens. For example, the fuel stations "Mogilevoblnefteprodukt" and a number of service stations are equipped with special containers for waste oil for people as well as for organizations. Then fuel stations, service stations and other organizations transport the collected oil to the enterprise in Minsk region. Waste oil is primarily burned for energy; there is one line for oil recovery (with low capacity). A couple of years ago it was possible to transport used tires to the cement factories (in Krichev and Kostyukovichi, Mogilev region), where they were burned in gas turbines. Now the factories are not working well, gas turbines are out of operation, so the number of options decreased. Recycling plant for used tires was constructed in Mogilev, but his capacity is not enough for recycling already accumulated used tires. Used tires fire from time to time, the last accident was in spring 2015 (Fig. 1.4.13). The city authorities want to solve the problem of these tires and somehow stimulate people not to throw out tires in the bushes. Only one place for tires recycling is really not enough for Mogilev Region.

Fig. 1.4.13: Fire at the landfill of used tires at Mogilev in the spring of 2015 (http://autogrodno.by/22-news/2/7681-v-mogileve-goryat-otrabotannye-shiny-foto-video.html)

Illegal turnover of SRM

Collection of SRM is one of the sources of illegal business. The development of illegal business depends on the prices for SRM in neighboring countries (for Mogilev region - mostly in Russia). As a rule, if prices are higher in Russia than in Belarus, the illegal collection of recyclables is organized (most cost-effective types are metal, waste

paper and plastic). Then SRM are transported to the collecting points for recyclables in Russia. The business is not shutting down even despite the extremely strict Belarusian legislation, demonstrational punitive measures and monitoring of metals turnover due to following reasons:

- the difference in prices is essential even now (the difference in prices has become smaller indeed due to economic crisis in Russia, but the economic situation in Russia is not so tragic as is represented in EU mass-media, especially in comparison with Belarus);

- low incomes at rural areas: there is almost no work for people in rural settlements and small towns, salaries are very low; therefore, SRM is almost only source for people to survive (see, for example, mass media publications about collective portrait of Asipovichy's villain (2012) http://www.gzt-akray.by/osipovichi/2012/12/Analiz-Kollektivnyj-portret-osipovichskogo-zlodeya /).

Staff of the Belarusian recycling enterprises says that they do not have enough materials collected in Belarus. They have to buy raw materials abroad, and it feels like they buying their own raw materials, which were removed by Belarusians to Russia (see "Border Business: Belarus buys a same scrap in Russia" (2011) http://news.tut.by/economics/242629.html).

The overall situation in Belarus and Russia and prices rule what people will collect illegally this year. The illegal collection of recyclables in Belarus is actively suppressed (see "Resident of Gomel was fined a 18 million for illegal delivery of 23 tons of scrap" 12.05.2015 → http://gomel.today/rus/news/gomel/56818/). Mainly small and single dealers can be easily caught. It is suspected that large and organized illegal business is slipping out from justice.

1.4.4 Regional legal and economic instruments to support waste management hierarchy

There are no special local economic and legislative instruments to support the SMW management. This is because Belarus is a small country, it is highly centralized. So SMW management is carried out on the basis of common national mechanisms and instruments.

1.4.5 Waste management system financing

Tariffs for removal, treatment and landfilling of SMW shall be established by the Solutions of the regional executive committees. Current tariffs for Mogilev and Mogilev district are shown in Tab. 1.4.11.

Tab.1.4.12 provides information about changes in tariffs over several years in Mogilev and Mogilev district (according to data of RD of HPU). As you can see, the

table is not complete, because some data is missing. Subsidized indexes which are applied in practice are represented in the Tab. 1.4.12.

Tab. 1.4.11: Tariffs for MSW rempval, treatment and landfilling in Mogilev city and Mogilev region*

Tariff	Bel. ruble / 1 m^3	Regulatory document
Utility service: removal, treatment and landfilling municipal solid waste		
Subsidized tariffs for the population:		Solution of the Mogilev Regional Executive Committee dated 23 January, 2015, № 3-18 (in the edition dated 18.11.2015 № 56-8)
in settlements of Mogilev District, except Mogilev	62 751,8	
in Mogilev	69 353,2	
The tariff, which provides full compensation of economically justified costs, with the exception of Mogilev	71 111,5	
in Mogilev	76 257,2	

* web-site Tariffs in Belarus http://www.tarify.by

It is clear that enterprise of sanitary cleaning are still working due to subsidies from the state, otherwise they would be completely unprofitable. Some of the financial results of companies are given in the Tab. 1.4.13. The information is not exhaustive, especially for Mogilev district. But some conclusions can be drawn from the figures below. Particularly, revenue from services are growing in absolute values, while expenses are increasing in the same pace. This causes the cost growth of all provided services and naturally lowers profits and profitability. Even a quick glance shows that the cost of services exceeds all established tariffs, and the gap keeps growing, which means that you need more and more subsidies. And one can't get more subsides because there is no extra money in the budget.

It seems a nice signal that the share of the sanitary cleaning falls from 92,9% in 2008 to 80,5% in 2015 due to increased recycling and other services. This indicates that enterprises keep working as good as they can by any means; and SRM collection can really help enterprises to be afloat.

The share of compensation of public services by the population is increasing gradually: from 24,7% in 2008 to 62,5% in 2015. This is the result of State policy to eliminate cross-subsidies in municipal sector. It is expected that people will gradually compensate 100 % of the expenses; and thus dissymmetry in the ratio expenses/tariffs will be destroyed. But the task is hard: a tariff rising is a very unpopular step, especially during the economic crisis, but it is a strong feeling that there's no other way.

Tab. 1.4.12: Dynamic of removal, treatment and landfilling fee for MSW*

Enterprise	*Fee, rub/ m³*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*
Mogilev city municipal organization "Special auto enterprise" (Mogilev)	*SMW removal fee:*												
	for population	2435			4005,2	4005,2	4764	2764	8000	14400	44250	51842	69353,2
	for legal entities	11576	11576	19296	20406	28365	28365	41186	54643	85258	95489	105038	121000
	SMW landfilling fee			914	965	1147	1147	1781	2744	43535	37100	47700	69300
Mogilev unitary municipal enterprise "Zhilkomhoz (Housing maintenance and utilities board)" (Mogilev district)	*SMW removal fee:*												
	for population									12780	39650	46889,8	62751,8
	for legal entities				32923	32923	32923	32923	43829	63175	70490	70449	70440

* data of RD HPU

Tab. 1.4.13: Financial results of sanitary cleaning companies in Mogilev city and Mogilev district*

Enterprise	*Parameter*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*
Mogilev city municipal organization "Special auto enterprise"	Taken out and landfilled of SMW – thousand m³	503,5	535,6	606,6	658,1	722,3	756,1	714,4	765,6	786,8	802,3	798,6	810,3
	including SMW from population	401,1	416,5	488,3	492,2	500	508	522	557	595	604	614	636
	Processing and sale of secondary raw materials (tons)		157,6	160,9	132	266,8	7703	1753	2299	2561	7436	7312	10546

	including: paper and cardboard		33,2	40,5	17	20	316	595	748	976	1465	2901	4268
	PET bottles		23,2	44	14	24	189	225	374	406	499	863	1537
	glass					78	464	764	968	980	1227	3123	3845
	textile					1,8	7	11	36	42	67	99	122
	scrap-metal (black + color)		97,2	75,6	101	143	136	155	168	151	147	246	578
	tires							3	5	11	31	80	196
	Service revenue (with taxes and subsidies from the state budget), mln. rubles, total	3043,3	3347	4328	5452	7314	8985	12686	18832	32776	53449	79626	95903
	sanitary cleaning, mln. rub.					6798	8320	11417	16576	28020	46682	58550	77104
	including revenue from population					1819	2239	2311	2942	5277	19534	27192	40478
	share of sanitary cleaning in total production, %					92,9	92,6	90	88	85,3	87,3	86,3	80,5
	recycling secondary raw materials, mln. rub.						260	529	1351	7667	4046	7253	84339
	share of the recycling in total production, %						2,9	4,2	7,2	8,1	7,6	9,1	14,9
	other services, mln. rub.					516	405	740	905	2092	2720	3823	4457
	share of other services in total production, %					7,1	4,5	5,8	4,8	6,4	5,1	4,8	4,6
	Taxes, mln. rub.	131,9	272	436	580	728	902	1409	2100	1463	4763	5670	6753
	Service revenue (excluding taxes), mln. rubles	2911,4	3075	3892	4872	6586	8083	11277	16732	29313	48686	73956	89147
	Expenses, mln. rubles, including:	2625,4	2827	3748	4523	5944	7934	20500	36168	28378	46172	69456	87597

	SMW removal and treatment					5604	6366	7688	11708	19485	31426	38762	29491
	recycling of secondary raw materials						1186	1964	2780	4590	9299	23641	28655
	other services					340	382	848	1680	4303	5452	13053	29451
	Prime cost of 1m³ (removal, treatment and recycling), rub.					8556	11332	13789	19520	31119	51655	72016	90942
	Profit, mln. rub., including:					642	149	777	564	935	2514	4500	1550
	Profitability, total, %	10,9	8,8	3,8	7,7	10,8	1,9	7,4	3,5	3,3	5,4	6,5	1,8
	Incomes (expenses) from all activities, mln. rub.												
	Net income, mln. rub.		67	138	11	295	1	58	60		1943	4876	25
	Expenses compensation from population, %					24,7	39,6	30	25,9	27,5	59,6	57,6	62,5
	Receivables of enterprises that recycle secondary raw materials, mln. rub.						41	25	145	284	1025	1562	1060
Mogilev unitary municipal enterprise “Zhilkomhoz (Housing maintenance and utilities board)”	SMW taken out and landfilled – thousand m³					78,8	90,1	87,2	86,4	88,9	90,5	108,3	96,2
	including: from population					69,1	79,9	77,5	75,5	79	81,4	99,7	87,3
	Recycling and selling of secondary raw materials (tons)					0	0 0	0	0	0	0	0	0
	Service revenue (with taxes and subsidies from the state budget), mln. rubles, total									2028,4	2231,2	2699,3	2804

	sanitary cleaning, mln. rub.									2028,4	2231,2	2699,3	2804
	Including revenue from population									633,4	1722,5	1799,7	2804
	secondary raw materials recycling, mln. rub.									0	0	0	0
	other services, mln. rub.									0	0	0	0
	Service revenue (excluding taxes), mln. rubles									2019,5	3957,7	4492,9	5437,5
	Expenses, mln. rub., including:									2019,5	3957,7	4492,9	5437,5
	Removal and treatment of SMW									2019,5	3957,7	4492,9	5437,5
	recycling of secondary raw materials									0	0	0	0
	other services									0	0	0	0
	Prime cost of 1m³ (removal, treatment and recycling), rub.									22716,5	43731,5	41485,7	56523

* * data of RD HPU

Financing of MSW management is provided predominantly from the republican and local budgets. The share of other sources is so tiny that it can be neglected. Of course, there is a need in attracting investment into the sector; and it is desirable to attract foreign investment, and reduce governmental share in all types of financing of MSW management.

But these desires are purely declaratory today:

- the investment climate in Belarus is not favorable;

- there are a lot of gaps in the legislation, there are no practical mechanisms of implementation declared aims, recycling is licensed, and etc.;

- business is not able to get the money which are in front of them –there is not enough creativity;

- bureaucracy, which can be a serious problem for any interventions.

1.4.6 Public awareness, education and communication initiatives

Of course, some nice and useful projects referred to in the review of Belarus come to life at the local and regional levels:

- “Zrobim! (“Let do it!”)” action;
- the traditional “Subbotniks”;
- “Target 99” action;

- resource-saving, environmental drawing, collecting recyclables and other (for example, in 2016 the competition "Planet Without Waste") contests for schoolchildren;

- “Operator of recyclables” place a variety of educational materials on their websites, see, for example, http://www.target99.by/post.php?id=14 ;

- MSW problem discussed in the mass-media; it is a crucial point of local self-government (perhaps because it is the only thing left in their credentials, but it does not really matter to them).

So Mogilev was not in the leaders on the initiation of events in this area. But generally low level of environmental awareness in regards to the solid waste associated not only with the lack of the events. What really is not enough is understandable and accessible information how to deal with MSW - it seems to be there, but an ordinary person can’t find it right before his eyes. For example, we have to tell each person (even to adults, not only children) about the Green map; or how to deal with plastic waste and etc. It is not enough, we can say, the molestation in WM ideas propaganda. And you can not put the blame on the mentality: in Soviet times people handed over glass milk bottles and paper on the exchange points to buy new books, people collected scrap metal and took part in “Subbotniks”. In Soviet times a good farm never had unused wastes, only a small

part of the most frequently used resources and materials became unnecessary waste. So we can say that the people are basically prepared for a separate waste collection and for the collection of SRM. Action of “Velcom” on collection of old phones demonstrated such willingness. It is necessary not only to create the conditions, but always to promote principles of MSW separate collection and to eliminate environmental awareness. Of course, one can remember that containers for separate collection could be filled with wrong trash and people are polluting the environment constantly, but the awareness in the field of WM could be raised even without the use of punitive measures.

We carried out a survey among the students of the Belarusian-Russian University and we will add the data about their environmental awareness and their habits in regards to waste after their processing.

1.4.7 Barriers and success factors for waste management performance

We sum up what was written above in order to compose future scenarios. We used well-known method – the SWOT analysis. Its results are shown in Tab. 1.4.14.

Tab. 1.4.14: Analysis of strengths and weaknesses of MSW management in Mogilev city and Mogilev region

Type of the system’s characteristics	Advantages	Weaknesses
Internal system characteristics	*Strengths:* - a good legal basis; - approved and clear policy in this area; - well preserved Soviet legacy and not initial development of the sector; - the desire and commitment to make a difference.	*Weaknesses:* - gaps in the legal regulation, the declarative nature of a number of legal norms, which complicates the practical side of things; - cross-subsidies and lower tariffs; - subsidized character of the activity and the lack of resources; - overlapping control functions in the different institutions; - authorities confusion; - unclear procedures of responsibility allocation; - passive community, failure to bring all of its members to fulfill the general obligations; - the lack of data and information on the system functioning.
External system characteristics	*Opportunities*: - a craze on the green economy, which led to a	*Threats*: - the economic crisis as a result of both internal and external causes;

	decrease in the cost of the green technologies and the development of legislative, technological and economic aspects of such activity; - a cooperation both with the EU and its eastern neighbors (the EEC, China); - instruments of international financial assistance and the financing of environmental projects, foreign investment.	- destabilization of the political situation in and around the country - strengthening of the authoritarian regime; - political and economic isolation of the country.

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web-site of "Beltsvetmetally" http://bcvm.by/zakupka-loma

web-site Tariffs in Belarus http://www.tarify.by

Reports and interviews

Reports and data of Regional Committee of MNREP
Reports and data of Regional Department of MHPU
Reports and data of SAE and ZUBR
Reports and data of Regional Department of statistic data

Interviews with:
Head of Regional Department of MHPU
Head of office on communal services of Regional Department of MHPU
Chief economist of SAE
Head of automobile department of SAE
Director of ZUBR
Head of City department of MHPU
Director of "Bel VTI"
Head of treatment facility for waste oil recycling of JCS "Mogilevoblnefteproduct"
Head of Regional Department of statistic data
Head of WM department of Regional Committee of MNREP
Staff of WM department of Regional Committee of MNREP (2 persons)
Locals at garden cooperative "Politechnik" (3 persons)
Locals living at private housing area in Mogilev city (Karabanovka mini-district) (11 persons)
Locals living at multi-story housing area in Mogilev city (30 let Pobedy mini-district) (4 persons)
Locals living at Shchezhar village in Mogilev district (2 persons)