REPORT

on second level mercury inventory in the Republic of Kazakhstan

KAZAKHSTAN • 2019

Content

List of abbreviations

CCP	-	Coke and chemical production
CIS	-	Commonwealth of Independent States
EAEU	-	Eurasian Economic Union
EMC	-	Extended manufacturer commitments
FEACN	-	Foreign economic activity commodity nomenclature
GDP	-	Gross Domestic Product
GEF	-	Global Environment Facility
JSC	-	Joint-stock company
LLP	-	Limited Liability Partnership
ME	-	Ministry of Energy
MES	-	Ministry of Education and Science
MF	-	Ministry of Finance
MFA	-	Ministry of Foreign Affairs
MH	-	Ministry of Health
MIA	-	Ministry of the Interior Affairs
MIID	-	Ministry of Industry and Infrastructure Development
MJ	-	Ministry of Justice
MLSP	-	Ministry of Labour and Social Protection
MM	-	Mass media
MNE	-	Ministry of National Economy
NCE	-	National Chamber of Entrepreneurs
PA	-	Production association
RI	-	Research Institute
RK	-	Republic of Kazakhstan
RSE	-	Republican State Enterprise
SDPP	-	State district power plant
SDW	-	Solid domestic waste
SRK	-	Standard of the Republic of Kazakhstan
TPP	-	Thermal power plant
UN	-	United Nations Organization
UNDP	-	United Nations Development Programme
USA	-	United States of America

Executive summary

1. Mercury inventory results

During the 2nd level of inventory, information was collected for 2016. The methodological basis was the Background Report and Level 2 Inventory Guidance «Methodology for Determination and Quantification of Mercury Receipts into the Environment» version 1.4 developed by the UN Environment Programme. The data collected have been incorporated into the Mercury Environmental Flow Calculation Table. The results are presented in Table 1.

Table 1 – Quantity of mercury receipts from different sources in 2016

Source category	Mercury, kg per year
Energy consumption	
Coal combustion at large power plants	1,436
Other ways of using coal (coke production)	274
Combustion/use of petroleum coke and heavy fuel	20
Combustion/use of diesel fuel, gasoline, oil, kerosene	175
Shale oil burning	106
Natural gas production	3,956
Use of untreated or pre-treated natural gas	185
Use of pipeline gas	11
Fuel production	
Oil production	205
Refining	87
Primary metal production	
Production of zinc from refined products	42,049
Production of copper from enriched products	315,087
Production of lead from enriched products	11,118
Gold mining by methods other than mercury amalgamation process	281,600
Alumina production from bauxite (aluminium production)	2,401
Production of primary ferrous metal (production of cast iron in dies)	180
Manufacture of other materials	
Cement production	203
Use and disposal of mercury-containing products	
Thermometers	851
Electrical switches and relays with mercury	2,509
Mercury-containing light sources	52
Mercury batteries	530
Other mercury manometers and sensors	90
Chemicals for laboratories	179
Other mercury-containing laboratory and medical equipment	716
Waste incineration	
Incineration of hazardous waste	1,767
Incineration of medical waste	583
Sewage sludge incineration	0.03
Waste disposal/disposal to landfill and waste water treatment	
Controlled waste/sediment dumps	14,068
Wastewater collection and disposal/treatment system	4,400
Crematoriums and cemeteries	
Cemeteries	326
TOTAL	**682,348**

Thus, in terms of the amount of mercury released, the main sources of mercury in Kazakhstan in 2016 were as follows:

1. Primary (native) metal production – 652,434 kg
2. Waste disposal/disposal into landfill and waste water treatment – 18,468 kg
3. Production and use of fuel/energy sources – 6,455 kg
4. Consumer goods with planned mercury use – 3,943 kg
5. Waste incineration – 2,350 kg
6. Other planned use of products/processes – 896 kg
7. Crematoriums and cemeteries – 326 kg
8. Production of other metals and materials with mercury impurities – 203 kg

According to the recommended methodology for conducting Level 2 of the mercury inventory, there are 6 ways of mercury flow: air, water, soil, by-products and impurities, conventional waste and special treatment/disposal sector.

Air. This category includes mercury emissions to the atmosphere from point and diffuse sources, sources from which mercury may spread locally or with air masses over long distances; e.g. point sources such as coal-fired power plants, metal production plants, landfill disposal or incineration, small-scale gold mining, and disposal of fluorescent lamps, batteries, thermometers.

Mercury discharges to water are generated by point and diffuse sources from which mercury is released to water bodies (e.g., flue gas wet treatment systems in coal-fired power plants, industrial and household products, surface runoff from mercury-contaminated soil, waste and dumps).

The sources of mercury discharges into the soil are the collected ashes from flue gas treatment at coal-fired power plants.

By-products and impurities that contain mercury tend to re-enter the market and cannot be directly attributed to emissions into the environment. Examples of products include gypsum plasterboard produced using ash from flue gas cleaning in coal-fired power plants, sulphuric acid with traces of mercury from flue gas desulphurisation (flue gas cleaning) in non-ferrous metal plants, chlorine and sodium hydroxide from mercury-based chlorine-alkali, metallic mercury or calomel as a by-product in the extraction of non-ferrous metals (high mercury concentrations).

Conventional waste is also referred to as municipal waste. Typically, this category is represented by household waste that is subject to general treatment, such as incineration, disposal or illegal disposal. Sources of mercury in waste are consumer goods with planned mercury use (batteries, thermometers, fluorescent lamps, etc.).

Special treatment/disposal sector. This category represents waste from industry and consumers that is collected and treated in separate systems, such as flue gas filters in coal-fired power plants, hazardous industrial waste with high mercury content, hazardous consumer waste with mercury content, separately collected and safely treated batteries, thermometers, mercury switches, teeth with amalgam seals, etc., tailings and large volumes of rock/waste from non-ferrous metal mining.

According to the inventory, in 2016 259,792 kg of mercury were released into the air, 13,121 kg into water, 262,146 kg into soil, 12,847 kg into by-products and impurities, 8,463 kg into general waste and 125,979 kg into the special treatment/disposal sector.

The percentage of mercury released to the environment is shown in Figure 1

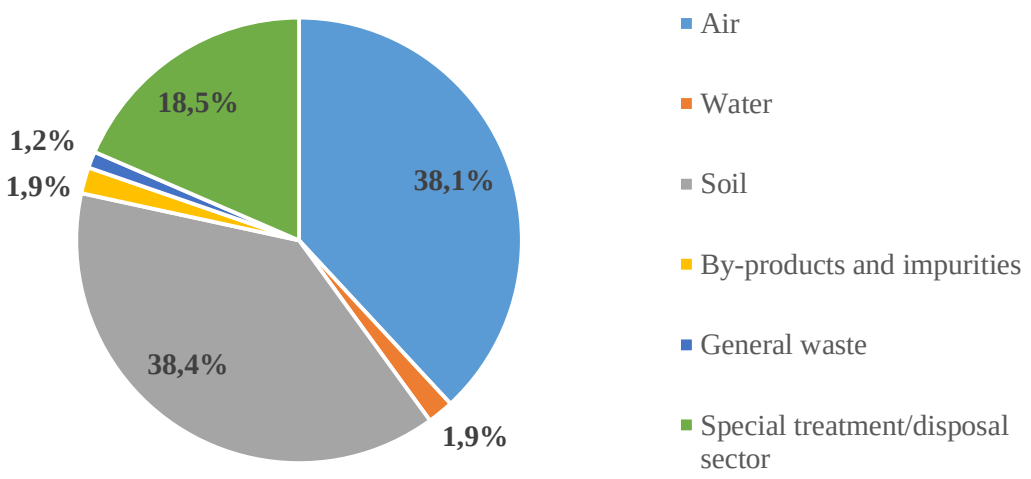

Figure 1 – Ratio of mercury released into the environment in 2016

As can be seen from Figure 1, the main mediums of mercury inflow in the Republic of Kazakhstan are air and soil (76.5%).

2. Main results of the state policy analysis and regulations

In the course of the analysis of the existing regulatory framework of the Republic of Kazakhstan, as well as the analysis of functions and powers of state bodies, a list of areas for further implementation of obligations under the Minamata Convention was formulated:

1. Development of measures to tighten control over imported and exported goods in terms of mercury content, as well as compliance with the relevant labelling and conformity of goods to the characteristics specified on the package;
2. Equipping relevant laboratories, training of staff and accreditation for mercury testing;
3. Development of the National Plan of Control over Emissions and Releases of Mercury and Mercury Compounds;
4. Development of a regulatory legal act regulating systematic comprehensive assessment of mercury emissions and releases to the environment;
5. Development of measures to ensure temporary storage of mercury and mercury compounds, which are not wastes, in an environmentally safe manner;
6. Inclusion in the Environmental Code of the Republic of Kazakhstan of a section devoted to mercury wastes, methods of their transportation, storage and utilization;
7. Consideration of the relevance of the development of a health screening program for the population living in the regions of historical mercury pollution;
8. Involvement of the most active representatives of civil society to address the issues of mercury and mercury waste disposal, as well as to work with the public to raise awareness about the impact of mercury on health and the environment;
9. Inclusion of studies aimed at assessing the impact of mercury in the state social order and scientific research programs.

More detailed information on the analysis of the current regulatory framework is presented in Chapter 3.

3. A summary of the measures that the country has identified as priorities in implementation of the provisions of the Convention

In the course of the second level of inventory, priority areas for the successful implementation of commitments under the Minamata Convention on Mercury were identified and implemented in the National Plan for the Reduction of Mercury Use and Collection.

In order to achieve the objectives of the Minamata Convention by the Republic of Kazakhstan, it is necessary to make an impact in the following directions:

1. Strengthening the legal and institutional framework for mercury management;

2. Identification and implementation of mechanisms for environmentally safe collection, storage and disposal of mercury;

3. Development and implementation of measures to monitor mercury inflows, collect and analyse data, and submit them to the Secretariat of the Minamata Convention;

4. Capacity building of stakeholders, conducting relevant scientific and clinical studies, awareness raising of public and stakeholders.

Introduction

On 10 October 2013, the text of the Minamata Convention on mercury was adopted and since then it has been open for signature. The objective of the Convention is to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds, and it sets out a number of measures required to achieve that objective. These include measures to control mercury trade, including restrictions on certain specific mercury sources, such as primary mining, and measures to control mercury-added products and manufacturing processes that use mercury or mercury compounds, as well as artisanal and small-scale gold mining. The text of the Convention includes separate articles on mercury emissions and releases, with measures to reduce mercury levels, while providing flexibility to take into account national development plans. It also contains measures related to the environmentally sound temporary storage of mercury and mercury waste, as well as contaminated sites. The text contains provisions for financial and technical support to countries, as well as a funding mechanism to ensure adequate, predictable and timely financial resources.

In 2017-2019, the United Nations Development Programme, with the support of the Global Environment Facility, implemented the Initial Assessment of Kazakhstan under the Minamata Convention in the Republic of Kazakhstan. The purpose of this project was to assist Kazakhstan in ratifying the Minamata Convention. One of the objectives of this project was to conduct an inventory of mercury in the Republic of Kazakhstan in 2016. The main guidance in conducting Level 2 of the inventory was the Background Report and Level 2 Inventory Guidance «Methodology for Determination and Quantification of Mercury Receipts to the Environment» version 1.4 developed by the United Nations Environment Programme (https://www.unenvironment.org/explore-topics/chemicals-waste/what-we-do/mercury/mercury-inventory-toolkit).

The inventory of mercury is one of the outputs of the project and contains general information about the country, analysis of regulations and existing gaps in the approaches to mercury management in the country, capacity development measures to be taken for ratification of the Minamata Convention, as well as a direct description of mercury sources and quantification of mercury inputs in 2016.

Also, this report contains a draft National Plan for Mercury Use Reduction and Collection. The implementation of this plan will require resource mobilization, including financial resources and discussion of the plan implementation mechanisms with stakeholders. This could be a lengthy process that requires a consistent multidisciplinary approach.

This report has been prepared with the participation of the following experts:

1. Nina Gor – Project manager
2. Mikhail Kim – Expert on data collection and analysis
3. Saltanat Bayeshova – Chemicals expert
4. Mikhail Hwan – Legislative expert
5. Gulshira Atemova – National Project director, acting director of the Waste management Department of the Ministry of Energy of the Republic of Kazakhstan
6. Zhanar Asanova – Director of the Waste management Department of Zhasyl Damu JSC
7. Asel Intymakova – Head of division of Waste management Department of the Ministry of Energy of the Republic of Kazakhstan
8. Kazken Orazalina – Hazardous waste expert

as well as Alexander Romanov – Deputy Director General of Atmosphere Research Institute for International Cooperation.

This project was implemented in close cooperation with the Waste Management Department of the Ministry of Energy of the Republic of Kazakhstan. In the process of collecting the necessary information, the Committee for Environmental Regulation and Control, the regional

Departments of Ecology, the Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan, the Committee on State Revenues of the Ministry of Finance of the Republic of Kazakhstan, as well as industrial enterprises and non-governmental organizations of the Republic of Kazakhstan were involved.

During the preparation of this report, a group of experts carried out the following work:

1. analysis of the Minamata Convention provisions;
2. analysis of the main sources of mercury in the Republic of Kazakhstan and sources of mercury data;
3. preparation and submission of official requests to the enterprises;
4. collection and analysis of information required for conducting mercury inventory;
5. conducting Level 2 of the mercury inventory using the Methodology for Determination and Quantitative Assessment of Mercury Receipts to the Environment, developed by the United Nations Environment Programme;
6. collection of information and analysis of mercury exports and imports in the Republic of Kazakhstan. Analysis of trade in mercury and its compounds in 2014-2016;
7. assessment of stocks of mercury and/or mercury compounds, including assessment of their storage conditions;
8. analysis of national legislation in terms of regulation of mercury management;
9. comparative analysis of the Minamata Convention provisions and their comparability with national legislation;
10. carrying out laboratory analysis of mercury content in Kazakhstani coal;
11. review of existing literature on mercury impact on human health;
12. engaging with key stakeholders and identifying their current capacity to implement the Minamata Convention.

Chapter I: Kazakhstan – background information

1.1 Geography and population

The Republic of Kazakhstan, occupying an area of 2 million 724.9 thousand square kilometres, is the ninth largest country in the world. In the north and west, the country has common borders with Russia – 7,591 km (the longest continuous land border in the world), in the east with China – 1,783 km, in the south with Kyrgyzstan – 1,242 km, Uzbekistan – 2,351 km and Turkmenistan – 426 km. The total length of land borders is 13,200 km (Figure 2).

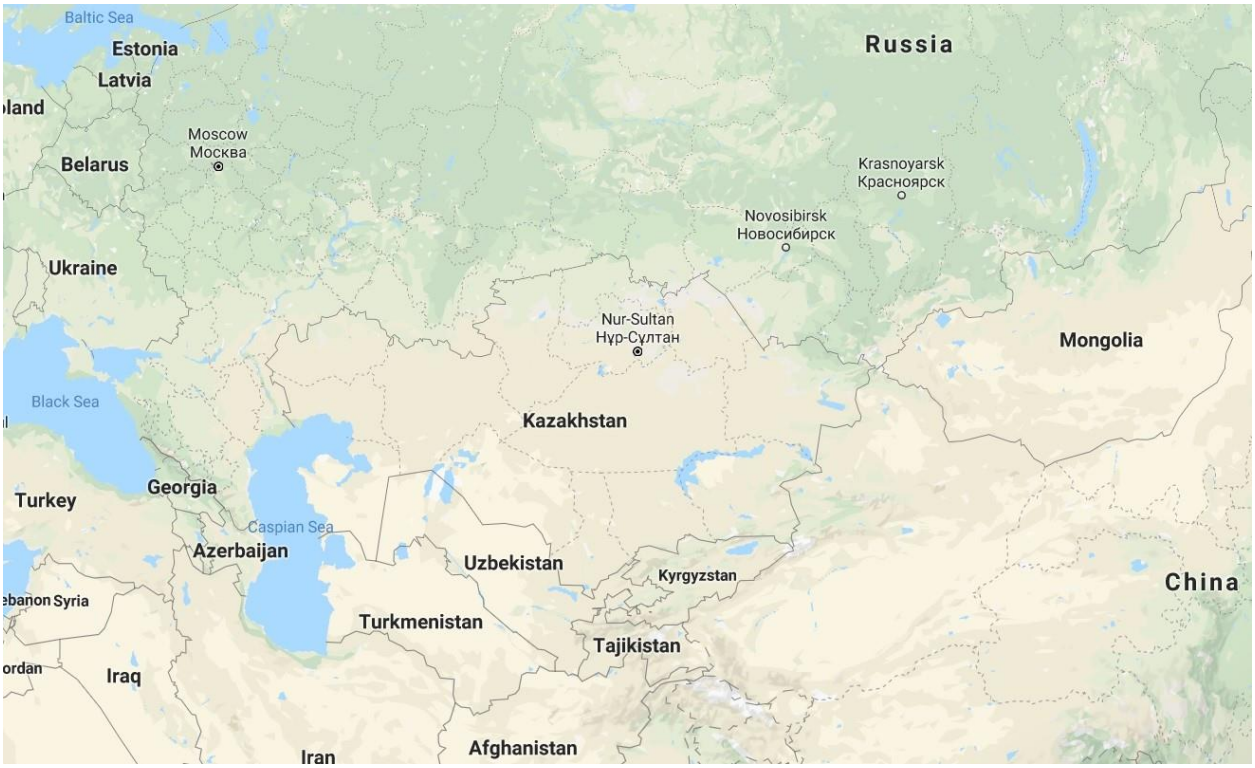

Figure 2 – Map of Kazakhstan[1]

Kazakhstan is the largest country in the world, which has no direct access to the oceans.

The climate in the country is mainly continental, with distinct seasons. The average temperature in January is -19 °C in the north and northeast to 1 °C in the south, the average temperature in July is 17 °C to 31 °C, respectively. Summers are hot and dry everywhere in the country. Temperatures can reach +50 °C (in Turkestan, South Kazakhstan region). Winter in the country is snowy and cold, the temperature can reach -58 °C (in the city of Atbasar in Akmola region and in the city of Pavlodar in Pavlodar region).

There are 7 large rivers in Kazakhstan, each of which is more than 1,000 km long. Among them: The Ural River (its upper course is located on the territory of Russia) flowing into the Caspian Sea; the Syrdarya River (its upper course is located in Kyrgyzstan, Uzbekistan and Tajikistan) – flowing into the Aral Sea; the Irtysh River (its upper course in China; on the territory of Kazakhstan it has large tributaries, the Tobol and Ishim) crosses the republic, and already on the territory of Russia flows into the Ob River, which in turn flows into the Arctic Ocean; the Ili River (its upper reaches are located on the territory of China) flows into Lake Balkhash.

There are many large and small lakes in Kazakhstan. The largest among them are the Caspian Sea, the Aral Sea, Balkhash, Alakol, Zaisan and Tengiz. Kazakhstan includes most of the northern part and half of the eastern coast of the Caspian Sea. The length of the Caspian Sea coast in Kazakhstan is 2,340 km.

[1] https://www.google.com/maps

There are 13 large reservoirs in Kazakhstan with a total area of 8,816 km² and a total water volume of 87,326 km³.

In terms of vegetation, the plain part of Kazakhstan is divided into three zones: steppe zone (feather grass, *Festuca sp.*, *Pleum sp.*), semi-desert zone (wormwood, *Stipa sp.)* and desert zone (drought-resistant shrubs).

Most of the territory of Kazakhstan is occupied by deserts – 44% and semi-deserts – 14%. The steppe zone occupies 26% of the territory of Kazakhstan, forests – 4.6%.

Forests occupy about 5.5% of the area of Kazakhstan and are located in the northern forest-steppe, eastern and southern mountainous parts of the country. There are about 6,000 species of plants on the territory of Kazakhstan, not including 500 species of introduced, cultivated and accidentally imported species. Water vegetation is the poorest (63 species) in the flora of the republic, but the oldest. Rare and endangered plants of Kazakhstan are subject to special protection (around 600 species), a significant part of which are included in the Red Book of Kazakhstan.

In modern fauna of Kazakhstan there are 172 species of mammals, 490 species of birds, 51 species of reptiles, 12 species of amphibians, over 100 species of fish. More than 50 thousand species of invertebrates (insects, crustaceans, molluscs, worms) and more than 30,000 species of insects alone are registered.

Kazakhstan possesses various minerals. In the depths of Kazakhstan 99 elements of the Mendeleev' periodic table are found, reserves on 70 of these are explored, more than 60 elements are involved in manufacture.

Currently, 493 deposits containing 1,225 types of mineral raw materials are known. Kazakhstan ranks first in the world in terms of proven reserves of zinc, tungsten and barite, second in terms of silver, lead and chromite, third in terms of copper and fluorite, fourth in terms of molybdenum and fifth in terms of gold.

The total population of Kazakhstan as of 1 August 2018 was 18,292,704.

Kazakhstan ranks 63 in the list of countries in terms of population. The average density is just over 6.71 people per km² (184th place in the list of countries by population density).

According to data as of the beginning of 2018, the Kazakhs constitute the majority of the population (67.47%). The following are Russians (19.76%), Uzbeks (3.18%), Ukrainians (1.53%), Uighurs (1.46%), Tatars (1.11%) and others.

According to data for 2017, the birth rate in Kazakhstan was 21.64 %, mortality – 7.15 %, and natural population growth – 14.46 %. In 2017, the number of registered marriages was 7.86 % and divorces 7.86 %. In 2017, the migration balance was: -22,130 (arriving: 946,415, departing: 968,545)[2].

1.2 Political, legal and economic profile

The Republic of Kazakhstan is a unitary state with a presidential form of government. According to the Constitution, the country asserts itself as a democratic, secular, law-based and social state, whose highest values are the individual, his life, rights and freedoms. Kazakhstan gained independence on 16 December 1991. The capital is the city of Nur-Sultan. The state language is Kazakh, and Russian has the status of a language of inter-ethnic communication. The monetary unit is the tenge.

The President of the Republic of Kazakhstan is the head of state, his highest official, who determines the main directions of domestic and foreign policy of the state and represents Kazakhstan within the country and in international relations.

The Government exercises executive power, heads the system of executive bodies and directs their activities.

Legislative functions are exercised by the Parliament, which consists of two Chambers – the Senate and the Mazhilis – operating on a permanent basis. The Senate is composed of members representing two persons from each region, city of national importance and capital city. Fifteen

[2] http://stat.gov.kz/faces/homePage?_adf.ctrl-state=y1d12aylw_50&_afrLoop=7154102442736274

members of the Senate are appointed by the President, taking into account the need to ensure the representation of the national cultural and other significant interests of society.

The Mazhilis consists of one hundred and seven deputies, nine of whom are elected by the Assembly of the People of Kazakhstan. The term of office of deputies of the Senate is six years, and that of deputies of the Mazhilis is five years.

The administrative-territorial structure of the country includes 14 regions and 3 cities of national importance[3].

1.3 Profiles of economic sectors

The country's mineral resource base consists of more than 5,000 deposits, the projected value of which is estimated at tens of trillions of dollars. The Republic ranks first in the world in terms of explored reserves of zinc, tungsten and barite, second in terms of silver, lead and chromites, third in terms of copper and fluorite, fourth in terms of molybdenum and sixth in terms of gold.

Kazakhstan also has significant oil and gas resources (the world's 9th largest proven oil reserves), which are concentrated in western regions. In addition, the republic ranks 8th in coal reserves and 2nd in uranium reserves.

Kazakhstan is one of the world's top ten grain exporters and one of the leaders in flour export. 70% of arable land in the north is occupied by grain and technical crops – wheat, barley, millet. In the south of the country rice, cotton and tobacco are grown. Kazakhstan is also famous for its gardens, vineyard, melons and gourds. One of the leading directions of agriculture is animal husbandry.

The main export goods are the products of mining, fuel and energy, metallurgical and chemical industries, as well as grain industry. The main trade partners of the republic are Russia, China, European and CIS countries.

The share of non-ferrous metallurgy in the total industrial output exceeds 12%. The extracted ores are used to produce copper, lead, zinc, titanium, magnesium, rare and rare-earth metals, rolled copper, lead, etc. In terms of production, Kazakhstan is one of the world's largest producers and exporters of refined copper. The republic's share in the global production of copper is 2.3%. At the same time, almost all copper produced in the country is exported abroad. The main importers of Kazakhstani copper are Italy, Germany and other countries. Kazakhstan is the third producer of gold among the new independent states, the extraction and production of which increases every year. About 170 gold-bearing deposits are registered in the country.

Kazakhstan ranks eighth in the world in terms of iron ore reserves. Its share in the world reserves is 6%. In addition to significant reserves, another advantage of Kazakhstan's iron ore is its relatively high quality. Of the 8.7 billion tonnes of iron ore, 73.3% are easily mined. More than 70% of the iron ore mined in the country is exported.

Currently, the export potential of Kazakhstan has a pronounced raw material orientation and is formed at the expense of the fuel, metallurgical and chemical complex. In the structure of Kazakhstan's exports, the main share is occupied by oil and oil products (35%), other important commodity groups are non-ferrous metals (17%), ferrous metals (16%), ores (12%).

As of 2016, Kazakhstan ranked eighth in the world in terms of proven coal reserves (25.6 billion tonnes, or 2.2% of global reserves) and tenth in the world in terms of production (102.4 million tonnes, or 1.4% of global production).

In 2016, according to British Petroleum, coal accounted for 56.5% of Kazakhstan's primary energy consumption, oil – 20.9%, natural gas – 19.1%, hydropower – 3.3%. Coal industry is one of the most important resource industries of the Republic of Kazakhstan. Coal reserves consist mainly of subbituminous coal. At the same time, there are reserves of brown coal as well as coking coal. The total volume of reserves is sufficient to maintain the current rate of production over a long period of time.

[3] http://www.akorda.kz/ru/republic_of_kazakhstan/kazakhstan

Kazakhstan has more than 300 deposits of fossil coal with 170.2 billion tonnes of geological reserves. The largest basins are Ekibastuz (12.5 billion tons), Karaganda (9.3 billion tons) and Turgai (5.8 billion tons). The largest reserves and the largest coal basins are related to Carbon (Karaganda and Ekibastuz coal basins) and Jurassic deposits. All known coking coal reserves are also concentrated in the Karaganda basin and satellite deposits – Samara and Zavyalovskoye.

In 2016, the regional production structure is divided into three regions: Pavlodar region (60% of production), Karaganda region (34%) and East Kazakhstan region (6%). Most of the coal in Kazakhstan – 70%. Is mined by open-pit mining at three giant deposits (Bogatyr, Northern and Eastern open-pit mines) in the Ekibastuz basin (Pavlodar region) and at four deposits (Borlinskoye, Shubarkolskoye, Kushokinskoye and Saryadyr) in Karaganda region. The remaining volumes of coal are mostly mined underground in the Karaganda basin (for the needs of local metallurgical enterprises) and at the Maikubenskoye deposit (lignite mining).

Coal industry is one of the largest branches of the country's economy, it provides 74% of electricity production, full utilization of coke and chemical production, and fully satisfies the fuel needs of the domestic sector and population.

1.4 Environment

Kazakhstan has a well-developed mining and processing industry, and in recent years these industries have been growing rapidly. Large industrial facilities are being built and put into operation, which has an impact on the environment in Kazakhstan.

The main sources of pollution are industry, agriculture, transport and other factors. The atmosphere is more sensitive, with gaseous and liquid pollutants entering its layers.

According to Article 31 of the Constitution of the Republic of Kazakhstan, «the state sets as its goal the protection of the environment favourable for human life and health», thus, the protection of the environment is one of the state priorities.

The main state body responsible for environmental protection is the Ministry of Energy of the Republic of Kazakhstan. The mission of the Ministry is «to develop the fuel and energy complex in order to ensure a high level of competitiveness, national and energy security, to meet the growing needs of the economy in energy, to develop the scientific and technological potential aimed at their effective use, as well as to create conditions for the preservation, restoration and improvement of environmental quality, to ensure the transition of the Republic of Kazakhstan to low-carbon development and a «green economy» to meet the demand».

The main normative legal act regulating relations in the field of ecology is the Environmental Code of the Republic of Kazakhstan dated January 9, 2007 № 212. In addition, the Republic of Kazakhstan has a large number of by-laws.

Kazakhstan has acceded to the following international conventions: Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (2003), Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (2007) and Stockholm Convention on Persistent Organic Pollutants (2007). Work is currently under way to accede to the Minamata Convention on Mercury.

Kazakhstan is a member of the Customs Union of the EAEU, and in this regard, the country has Technical Regulations of the Customs Union, which regulate the content of mercury in imported products.

Despite the measures taken, there are still some gaps in the existing system in the country, namely:

1. the mechanisms for sorting and processing household waste are not fully developed;
2. lack of regulations and methods to control mercury emissions from industrial enterprises and TPPs;
3. lack of developed mechanisms for collection and disposal of mercury-containing products;

4. lack of developed mechanisms of impact on industrial enterprises in terms of installation of treatment systems.

Chapter II: Mercury inventory and identification of emissions and sources

2.1 Estimation of mercury emissions, stocks, supplies and trade

Different sources of information were used in conducting Level 2 of the mercury inventory. Thus, in order to collect information, requests were sent to power plants, oil producing and refining companies, car fleets, metallurgical enterprises, etc. Information was received from more than 300 companies operating in the Republic of Kazakhstan. Also, the official statistical data for 2016 prepared by the Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan (http://stat.gov.kz) and the Committee on State Revenues of the Ministry of Finance of the Republic of Kazakhstan (http://kgd.gov.kz/ru) were used to carry out the mercury inventory.

In preparing the literature review, freely available sources of information (research results, publications in scientific literature, international guidelines, reviews and dissertations) were used.

2.1.1 Types of mercury sources

Currently, Kazakhstan does not produce or export mercury. Kazakhstan also has no industrial production facilities that use mercury. This makes it unnecessary to import metallic mercury. However, like most countries in the world, Kazakhstan does not restrict imports of goods based on the mercury they contain: batteries, mercury thermometers, paints, antiseptics and medicines, etc., while the import of fluorescent lamps is constantly being expanded and encouraged.

Table 2 provides a list of mercury emission sources in the Republic of Kazakhstan. The following designations were used in preparing the table: presence (Yes), absence (No) of sources, and possible sources, but not defined as undoubtedly present (?).

Table 2 – Identification of mercury emission sources in the Republic of Kazakhstan

Source category	Presence of source
Energy consumption	
Coal combustion at large power plants	Yes
Other uses of coal	Yes
Combustion/use of petroleum coke and heavy fuel	Yes
Combustion/use of diesel fuel, gasoline, oil, kerosene	Yes
Oil shale burning	Yes
Biomass power plants and heat generation	No
Charcoal burning	?
Fuel production	
Oil production	Yes
Refining	Yes
Extraction, processing and transportation of natural gas.	Yes
Primary metal production	
(Primary) mercury extraction and initial treatment	No
Production of zinc from refined products	Yes
Production of copper from enriched products	Yes
Production of lead from enriched products	Yes
Gold mining by methods other than mercury amalgamation	Yes
Alumina production from bauxite (aluminium production)	Yes
Production of primary ferrous metal (production of cast iron, steel)	Yes
Gold mining through a mercury amalgamation process without the use of retort furnaces	No
Gold mining through a mercury amalgamation process using retort furnaces	No

Manufacture of other materials	
Cement production	Yes
Production of pulp and paper	Yes
Manufacture of chemical elements and polymers	
Production of chlor-alkali using mercury electrolysers	No
Manufacture of vinyl chloride with a mercury catalyst	No
Acetaldehyde production with mercury catalyst	No
Manufacture of mercury-containing products	
Mercury thermometers (medical, air, laboratory, industrial, etc.)	No
Electrical switches and relays with mercury	No
Mercury-containing light sources (fluorescent, compact, other: see manual)	No
Mercury batteries	No
Mercury manometers and sensors	No
Mercury-containing biocides and pesticides	No
Mercury-containing paints	No
Skin whitening creams and soap containing mercury elements	No
Use and disposal of mercury-containing products	
Amalgam for dental fillings («silver» fillings)	No
Thermometers	Yes
Electrical switches and relays with mercury	Yes
Mercury-containing light sources	Yes
Mercury batteries	Yes
Polyurethane (PU, PUR) obtained with mercury catalyst	No
Paints with mercury-containing stabilizers	?
Creams for bleaching of a skin and soap containing elements of mercury	?
Medical tonometers (mercury sphygmomanometers)	No
Other mercury pressure gauges and sensors	Yes
Chemicals for laboratories	Yes
Other mercury-containing laboratory and medical equipment	Yes
Production of reduced metals	
Production of recycled mercury («secondary production»)	No
Production of reusable ferrous metals (cast iron and steel)	No
Waste incineration	
Incineration of municipal/common waste	No
Incineration of hazardous waste	Yes
Incineration of medical waste	Yes
Sewage sludge incineration	Yes
Waste incineration on open fire (landfills and at random)	No
Waste disposal and waste water treatment	
Controlled waste/ sediments dumps	Yes
Unauthorised dumping of conventional waste (landfills)	Yes
Wastewater collection and disposal/treatment system	Yes
Crematoriums and cemeteries	
Crematoria	No
Cemeteries	Yes

Thus, in the Republic of Kazakhstan, almost all sources of mercury have been identified, except for the following: paints with mercury-containing stabilizers (information on the content of mercury in the paint is not available), cosmetics with a bleaching effect (no study of creams for the presence of mercury in them has also been conducted), production of reusable ferrous metals (the Republic of Kazakhstan has a program for the disposal of automobiles, but it was launched in

November 2016, so data for 2016 are not available), incineration of waste on open fire (as a rule, the waste is ignited spontaneously at the landfills and there is no reporting of the amount of burnt waste).

Further, Table 3 presents mercury sources described in the Methodology but not included in the quantitative inventory; with a preliminary indication of possible presence in the country: presence (Yes), absence (No) of sources and possible sources, but not identified as unconditionally present (?).

Table 3 – Other possible sources of mercury in the Republic of Kazakhstan

Source category	**Presence of source**
Burning peat	No
Production of geothermal energy	No
Production of other reusable metals	Yes
Lime production	Yes
Manufacture of lightweight fillers (fired clay, fine coal for construction processes)	Yes
Production of other chemicals (except sodium hydroxide chlorine) at chlor-alkali facilities using mercury electrolyser technology	No
Production of polyurethane with mercury catalyst	No
Seed treatment with mercury-containing elements	No
Semiconducting infrared detection devices	?
Buzz-tubes and tubes of the Kantor (the medical equipment)	?
Use for educational purposes	Yes
Mercury gyroscopes	?
Mercury vacuum pumps	?
Mercury used in religious rituals (amulets and other uses)	No
Mercury used in traditional and homeopathic medicine	No
Use of mercury as a coolant in some cooling systems	No
Beacons (levelling bearings in sea navigation beacons)	?
Mercury in large bearings with rotating mechanical parts, e.g. in older wastewater treatment plants	No
Tanning	No
Pigments	No
Bronze and steel pickling products	No
Special types of coloured photographic paper	No
Rollback shock absorbers	No
Explosives (rattling mercury, etc.)	No
Pyrotechnic products	No
Souvenirs for the office	No

2.1.2 Anthropogenic mercury sources

Sources of mercury inputs to the environment are of both natural and anthropogenic origin. Natural sources of mercury include natural weathering of mercury-containing rocks, as well as volcanic eruptions. The main industrial sources of atmospheric mercury are: coal combustion, mining, industrial activities, production of various metals, as well as raw materials for cement production. As part of this activity, mercury enters the atmosphere because it is present as an admixture in the fuel or raw material. The second source category includes sectors of industry in which mercury is intentionally used. Pollution also occurs from industrial plants where mercury and its compounds are used in technological processes (chlorine-alkali production, vinyl chloride

production). The same number of wastes generated by the use of mercury-containing products (damaged thermometers and lamps, mercury-containing galvanic elements, etc.)[4].

The amount of mercury generated by humans can be divided into the following estimated percentages:

1. 65% – stationary combustion of fuel
2. 11.1% – gold mining
3. 6.9% – non-ferrous metals production
4. 6.5% – cement production
5. 3% – waste disposal, including municipal and hazardous waste, crematoriums and sludge incineration
6. 3% – caustic soda production
7. 1.4% – iron and steel production
8. 1.1% – mercury production
9. 2% – other sources

In this document, the factors of mercury entry into society should be understood as the amount of mercury available for possible environmental inputs from economic activities in the country.

This includes mercury, which is specifically used in products such as thermometers, tonometers, fluorescent lamps, etc. It also includes mercury derived from the extraction and use of raw materials containing mercury in the concentration of traces. Information on the quantitative indicators of mercury ingress into the environment in 2016 is presented in Table 4.

Table 4 – Summary information on mercury input factors in 2016

Source category	**Presence of source**	**Economic activity indicators**	**Unit of measure**	**Estimated input Hg, kg Hg/year**
Energy consumption				
Coal combustion at large power plants, t/a	Yes	47,852,795	Combined coal, t/a	1,436
Other ways of using coal (coke production)	Yes	9,148,564	Used coal, t/year	274
Combustion/use of petroleum coke and heavy fuel	Yes	977,631	Burned petroleum products, tons/year	20
Burning/use of diesel fuel, gasoline, oil, kerosene	Yes	87,665,819	Burned petroleum products, tons/year	175
Shale oil burning	Yes	1,327,003	Shale oil burning, t/year	106
Natural gas production	Yes	39,560,832,094	Used gas, Hm^3/yr	3,956
Use of untreated or pre-treated natural gas	Yes	1,845,949,617	Used gas, Hm^3/year	185
Use of pipeline gas	Yes	50,646,793,471	Gas used, Hm^3/yr	11
Charcoal burning	?	0	Burned charcoal, t/year	0
Fuel production				
Crude oil production	Yes	60,410,439	Crude oil produced, tonnes per year	205

[4] UNEP, 2013. Global Mercury Assessment 2013: Sources, Emissions, Releases and Environmental Transport. UNEP Chemicals Branch, Geneva, Switzerland.

Oil refining	Yes	25,480,384	Crude oil refined, tonnes per year	87
Primary metal production				
Production of zinc from enriched products	Yes	646,900	Used enriched product, t/year	42,049
Production of copper from enriched products	Yes	10,502,900	Used enriched product, t/year	315,087
Production of lead from enriched products	Yes	370,600	Used enriched product, t/year	11,118
Gold mining methods other than mercury amalgamation process	Yes	18,773,300	Gold ore used, t/a	281,600
Alumina production from bauxite (aluminium production)	Yes	4,802,200	Processed bauxite, t/y	2,401
Production of primary ferrous metal (production of pig iron in pigs)	Yes	3,595,090	Production of pig iron in pigs, t/year	180
Manufacture of other materials				
Cement production	Yes	1,847,405	Cement produced, t/year	203
Production of pulp and paper	Yes	350	Biomass used for production, t/year	0.01
Use and disposal of mercury-containing products				
Thermometers	Yes	851,247	Number of sold items/year	851
Electrical switches and relays with mercury	Yes	17,918,214	Number of inhabitants	2,509
Mercury-containing light sources	Yes	4,573,949	Number of sold items/year	52
Mercury batteries	Yes	448	Number of sold batteries, t/year	530
Paints with mercury-containing stabilizers	?	0	Paint sold, t/year	?
Creams for bleaching of a skin and soap with the maintenance of elements of mercury	?	0	Sold cream or soap, t/year	?
Other mercury manometers and sensors	Yes	17,918,214	Number of inhabitants	90
Chemicals for laboratories	Yes	17,918,214	Number of inhabitants	179
Other mercury-containing laboratory and medical equipment	Yes	17,918,214	Number of residents	716
Production of reduced metals				
Production of recycled mercury («secondary production»)	No	0	Mercury produced, kg/year	?

Production of reusable ferrous metals (cast iron and steel)	?	0	Quantity of reused transport/year	?
Waste incineration				
Incineration of hazardous waste	Yes	73,626	Burnt waste, t/year	1,767
Incineration of medical waste	Yes	24,306	Burnt waste, t/year	583
Sewage sludge incineration	Yes	15	Burnt waste, t/year	0.03
Incineration of waste on open fire (landfills and at random)	No	0	Burnt waste, t/year	0
Waste disposal/disposal to landfill and waste water treatment				
Controlled waste/sediment dumps	Yes	2,813,600	Waste disposed at landfills, tonnes/year	14,068
Unauthorized dumping of ordinary waste	?	0	Wastes disposed on spontaneous landfills, t/year	?
Wastewater collection and disposal/treatment system	Yes	838,001,377	Wastewater, m3/year	4 400
Crematoriums and cemeteries				
Cemeteries	Yes	130,532	Number of buried corpses/year	326
TOTAL				**682,348**

As can be seen from Table 4, in terms of the amount of mercury released, the main sources of mercury in Kazakhstan in 2016 were as follows

1. Primary (native) metal production – 652,434 kg
2. Waste disposal/disposal into landfill and waste water treatment – 18,468 kg
3. Production and use of fuel/energy sources – 6,455 kg
4. Consumer goods with planned mercury use – 3,943 kg
5. Waste incineration – 2,350 kg
6. Other planned use of products/processes – 896 kg
7. Crematoriums and cemeteries – 326 kg
8. Production of other metals and materials with mercury impurities – 203 kg

2.1.3 Mercury inputs to the environment

Mercury is a rare element. Its average content in the earth's crust and main rock types is estimated at 0.03-0.09 mg/kg, i.e. 1 kg of rock contains 0.03-0.09 mg of mercury, or 0.000003-0.000009% of the total mass (for comparison – one mercury lamp, depending on the design, may contain 20 to 560 mg of mercury, or 0.01 to 0.50% of the mass). The mass of mercury concentrated in the surface layer of the Earth's crust at 1 km is 100,000,000,000,000 tons (one hundred billion tons), of which only 0.02% is in its own deposits. The remainder of the mercury is in a state of extreme dispersion, mainly in rock (41.1 million tons of mercury have been dispersed in ocean waters, resulting in a low average concentration of 0.03 μg/l in its waters). This scattered mercury that creates the natural geochemical background on which the mercury pollution caused by human activity and leading to the formation of anthropogenic pollution zones in the environment is imposed.

Mercury is not only concentrated in mercury minerals, ores and the rocks that contain them. According to the Clark-Vernadsky law on the general dispersion of chemical elements, mercury is found in certain amounts in all objects and components of the environment, including meteorites and lunar soil samples. Increased concentrations of mercury contain in ores of many other minerals (polymetallic, copper, iron, etc.). Mercury accumulation in bauxites, some clays, shale oil, limestone and dolomites, coal, natural gas and oil has been established. Modern data indicate a high content of mercury in the mantle (the second from the surface, after the Earth's crust), as a result of the degassing of which, as well as the natural process of evaporation of mercury from the Earth's crust (rocks, soils, water), there is a phenomenon called «mercury breathing of the Earth». These processes are ongoing, but are activated by volcanic eruptions, earthquakes, geothermal events, etc.

Entry of mercury into the environment because of the Earth's mercury breathing (natural emission) is about 3,000 tons per year. Entry of mercury into the atmosphere, caused by human industrial activity (man-made emission), is estimated at 3,600-4,500 tons per year.

In turn, man-made mercury emission is formed as a result of intentional use of mercury in technological processes, as well as a result of its unintentional formation when using natural raw materials containing mercury as an admixture.

Unintended sources of mercury include combustion, purification and processing of fossil fuels, mining and processing of metal ores, and use of mercury-containing materials in high-temperature processes such as cement production. Although mercury impurities in natural raw materials are present in trace concentrations, high levels of mercury consumption result in significant environmental mercury releases.

According to the Recommended Methodology for Level 2 of the mercury inventory, there are 6 ways of entering mercury: air, water, soil, by-products and impurities, conventional waste, special treatment/disposal sector.

Air. This category includes mercury emissions to the atmosphere from point and diffuse sources, sources from which mercury can spread locally or over long distances with air masses; e.g. point sources, such as coal-fired power plants, metal production plants, landfill disposal or incineration, small-scale gold mining, disposal of fluorescent lamps, batteries, thermometers.

Mercury discharges to **water** are generated by point and diffuse sources from which mercury is released to water bodies (e.g., flue gas wet treatment systems in coal-fired power plants, industrial and household products, surface runoff from mercury-contaminated soil, waste and dumps).

The sources of mercury discharges into the **soil** are also ashes collected from flue gas treatment at coal-fired power plants.

By-products and impurities that contain mercury tend to re-enter the market and cannot be directly attributed to emissions into the environment. Examples are: gypsum plasterboard produced using ash from flue gas cleaning in coal-fired power plants, sulphuric acid with traces of mercury from flue gas desulphurisation (flue gas cleaning) in non-ferrous metal plants, sodium chloride and hydroxide from mercury-based chlorine-alkali, metallic mercury or calomel as a by-product in the extraction of non-ferrous metals (high mercury concentrations).

Conventional waste is also referred to as municipal waste. Typically, this category is represented by household waste that is subject to general treatment, such as incineration, disposal or illegal disposal. Sources of mercury in waste are consumer goods with planned mercury use (batteries, thermometers, fluorescent lamps, etc.).

Special treatment/disposal sector. This category represents waste from industry and consumers that is collected and treated in separate systems, such as flue gas filters in coal-fired power plants, hazardous industrial waste with high mercury content, hazardous consumer waste with mercury content, separately collected and safely treated batteries, thermometers, mercury switches, teeth with amalgam seals, etc., tailings and large volumes of rock/waste from non-ferrous metal mining.

Table 5 provides information on mercury inflows in 2016 from all available source categories. The main ways in which mercury enters the environment are emissions and flows into the air and soil.

Table 5 – Summary information on mercury release factors in 2016

	Estimated mercury yield factor, kg/year					
	Air	**Water**	**Soil**	**By-products and admixtures**	**General waste**	**Special treatment/disposal sector**
Extraction and use of fuel/energy sources						
Coal combustion in power plants	868	0	0	0	0	568
Other uses of coal	1,274	0	0	0	0	0
Oil Fuel – extraction, purification and use	310	81	39	39	9	9
Natural gas – production, processing and use	868	791	0	1,503	0	989
Other fossil fuels – extraction and use	106	0	0	0	0	0
Biomass power plants and heat generation	0	0	0	0	0	0
Geothermal power generation	0	0	0	0	0	0
Primary (native) metal production						
(Primary) mercury extraction and initial treatment	0	0	0	0	0	0
Gold (and silver) mining through the mercury amalgamation process	0	0	0	0	0	0
Zinc extraction and initial processing	27,500	505	0	0	0	14,044
Copper extraction and initial processing	206,067	3,781	0	0	0	105,239
Extraction of lead and initial processing	7,271	133	0	0	0	3,713
Gold mining and initial processing by methods other than mercury amalgamation	11,264	5,632	253,440	11,264	0	0
Aluminium extraction and initial processing	360	240	0	0	1,561	240
Other non-ferrous metals – mining and processing	0	0	0	0	0	0
Production of primary ferrous metal	171	0	0	0	0	9
Manufacture of other metals and materials with mercury impurities						
Cement production	81	0	0	41	0	81
Production of pulp and paper	0	0	0	0	0	0
Manufacture of lime and lightweight aggregates	0	0	0	0	0	0
Planned use of mercury in industrial processes						
Production of chlor-alkali using mercury electrolysers	0	0	0	0	0	0
Vinyl chloride production with mercury catalyst	0	0	0	0	0	0
Acetaldehyde production with mercury catalyst	0	0	0	0	0	0
Other production of chemical elements and polymers with mercury	0	0	0	0	0	0
Consumer goods with planned mercury use						
Mercury thermometers	170	255	170	-	255	0

Electrical switches and relays with mercury	753	0	1,004	-	753	0
Mercury-containing light sources	3	0	0	-	49	1
Mercury batteries	133	0	133	-	265	0
Polyurethane with mercury catalysts	0	0	0	-	0	0
Mercury-containing biocides and pesticides	0	0	0	0	-	0
Mercury-containing paints	0	0	0	0	-	0
Pharmaceuticals used in medicine and veterinary medicine	0	0	0	-	0	0
Cosmetics and related mercury-containing goods	0	0	0	0	-	0
Other planned use of products/processes						
Mercury for amalgam fillings	0	0	0	0	0	0
Mercury gauges and sensors	0	0	0	0	0	0
Mercury-containing laboratory chemicals and equipment	0	296	0	0	296	305
Use of mercury metal in religious rituals and folk medicine	0	0	0	0	0	0
Other uses of products, use of mercury-containing metal and other sources	0	0	0	0	0	0
Production of recycled mercury («secondary» metal production)						
Production of recycled mercury («secondary production»)	0	0	0	0	0	0
Production of reusable ferrous metals (cast iron and steel)	0	0	0	0	0	0
Production of other reusable metals	0	0	0	0	0	0
Waste incineration*3						
Incineration of municipal/common waste	0	0	0	0	0	0
Incineration of hazardous waste	1,643	0	0	0	0	124
Incineration of medical waste	543	0	0	0	0	41
Sewage sludge incineration	0	0	0	0	0	0
Unauthorized waste incineration	0	0	0	0	0	0
Waste disposal/disposal to landfill and waste water treatment						
Controlled waste/sediment dumps*3	1,407	1,407	7,034	0	4,220	0
Disposal of scattered mercury with some control	-	-	-	-	-	-
Unauthorized local disposal of industrial waste	0	0	0	-	-	-
Unauthorized disposal of general waste *1*3	0	0	0	-	-	-
Wastewater collection and disposal/treatment system*2	0	2,728	0	0	1,056	616
Crematoriums and cemeteries						
Crematoria/crematoriums	0	0	0	-	0	0
Cemeteries	0	0	326	-	0	0
TOTAL*1*2*3*4	**259,792**	**13,121**	**262,146**	**12,847**	**8,463**	**125,979**

Note:

**1: Estimated quantity includes mercury in products that have also been included for each product category. To avoid double counting, landfills from unauthorized discharges of general waste were automatically subtracted from the TOTAL value.*

**2: Estimated input factor to the aquatic environment includes the amount of mercury that has already been taken into account for each source category. To avoid double counting, the ingress factors from the wastewater treatment system were automatically subtracted from the TOTAL value.*

**3: To avoid double counting of mercury inputs from waste and products at the inlet, only 10% of mercury inputs to waste incineration sources, landfill disposal and unauthorized disposal are included in the total number of mercury inputs. These 10% are approximately the same as mercury inputs from materials that have not been identified individually in Tier 1 of the inventory.*

**4: To avoid double counting of mercury in domestically produced products (including oil and gas), only a fraction of the mercury entering production is included in the total value.*

As can be seen from Table 5, the main directions of mercury inflow in the Republic of Kazakhstan in 2016 were air (38.1%) and soil (38.4%).

2.1.4 Mercury stocks and trade

As of 2015, 422 tonnes of metallic mercury had accumulated in the territory of some enterprises, including 24.4 kg of ownerless mercury in Kostanay region, which is temporarily stored in the territory of a specialized enterprise.

This figure is not included in the calculation table, as the activity indicator is «produced mercury, kg/year», and this volume of mercury is formed over a fairly long period of operation of enterprises.

2.2 Identified mercury contaminated sites

Currently, there are 2 sites of historical mercury pollution in the Republic of Kazakhstan: the former acetaldehyde production of PA «Karbid» in Temirtau and the former chlorite-alkali production of PA «Khimprom» in Pavlodar.

More detailed information on this issue is provided in section 2.12 Mercury and/or mercury compounds and storage conditions.

2.3 Fuel/energy extraction and utilization data

The mercury source category «energy consumption and fuel production» includes power plants, industrial furnaces, and space heating plants operating on fossil fuels, biogas, including organic waste gas, and biomass. It also includes the extraction and transportation of natural gas, oil and other fossil fuels. In order to specify the sources, the category has been divided into the following main subcategories:

1. coal combustion at large power plants with a boiler output exceeding 300 MW;
2. other uses of coal, e.g. smaller combustion plants, residential heating, and other uses of coal, such as coke production;
3. extraction, treatment and use of oil and petroleum fuel, i.e., all mercury emissions in the life cycle of oil and petroleum fuel, e.g., heating, power generation, transport, synthesis of chemicals and polymers, soot production, etc.;
4. extraction, treatment, transportation and use of natural gas, i.e. all mercury emissions in the life cycle of natural gas, e.g. heating, energy production, transport, chemical and polymer synthesis, soot production, etc.;
5. burning shale oil;
6. production of energy and heat using biomass, wood, straw, etc.

Calculation of mercury inflow from this category was based on the data obtained in the course of inquiries to more than 300 enterprises engaged in extraction, processing, transportation of coal, oil and gas, as well as power plants.

The total volume of mercury input to the environment from this category of mercury sources was **6,455** kg. Below is an explanation for the calculation of emissions from each subcategory.

2.3.1 Coal Combustion at large power plants

Globally, coal combustion is the most important source of anthropogenic mercury emissions into the atmosphere. Coal is used to produce heat and electricity in various sectors using different combustion technologies.

This subcategory covers large combustion plants (usually with a boiler with a capacity greater than 300 MW). Most of these enterprises are power plants; some of them also supply heat (district heating, etc.). The basis for a separate description of such large coal-fired power plants is that in many countries they consume most of the coal used in the national economy and are often equipped with efficient, individually configured emission reduction systems. Such equipment captures part of the mercury emissions, which reduces direct emissions to the atmosphere.

As one of the most dangerous toxic substances, mercury attracts close attention of the public, experts from different fields of knowledge. Thermal energy has been and remains one of the main sources of mercury in the environment. Mercury has unique features: low melting point (-38.9°C) and high vapour elasticity (boiling at T = 356.66°C). This means that at coal combustion temperatures mercury can only be in the form of elementary mercury vapour Hg0. Due to such properties, the most important technological feature of mercury is its volatility[5].

The concentration of mercury in the coal used is a major factor in determining mercury emissions from this sector. Pre-combustion of coal allows for the removal of some of the mercury from the coal.

In coal combustion plants not equipped with emission reduction systems or equipped only with large particle filters (electrostatic precipitators), all or most of the mercury inputs are directly emitted to the atmosphere. This is because, unlike other heavy metals, most of the mercury in the exhaust gases remains in the gas phase. The release of mercury is increasing worldwide, due to the predominance of coal-fired power plants that release mercury from coal combustion, as well as growing energy demand[6].

The default input factor recommended by the Methodology is based on an average value of 0.15 g Hg/t of combusted coal.

In conducting Level 2 of the Mercury Inventory in the Republic of Kazakhstan, a laboratory study of the mercury content of Kazakhstani coal was conducted. Coal from the following large deposits was analysed: Pavlodar region – Ekibastuz basin (Bogatyr opencast mine, Northern opencast mine), Maikubenskiy basin, Karaganda region – Shubarkolskoye deposit, East Kazakhstan region – Karazhyr deposit. Thus, the average value of 0.03 g Hg/t of burnt coal was accepted as an input factor.

According to the Forecast Scheme of Territorial and Spatial Development of the country until 2020, approved by the Decree of the President of the Republic of Kazakhstan dated July 21, 2011 № 118, Kazakhstan ranks 7th in the world in terms of proven coal reserves and tenth in the world in coal production. On the territory of Kazakhstan there are more than 400 deposits and manifestations of hard and brown coal of different ages.

The coal industry of Kazakhstan is one of the largest sectors of the country's economy. In terms of coal reserves, Kazakhstan is one of the top ten countries, second only to China, the United States, Russia, Australia, India and Ukraine. The state balance sheet accounts for the reserves of 49 deposits, amounting to 33.6 billion tons, including 21.5 billion tons of hard coal and 12.1 billion tons of brown coal. Most of the coal deposits are concentrated in the Central (Karaganda and Ekibastuz coal basins, as well as the Shubarkol deposit) and Northern (Turgai coal basin) Kazakhstan. The Republic of Kazakhstan is one of the top ten largest coal producers on the world market, and ranks third among the CIS countries in terms of reserves, second in terms of production and first in terms of per capita coal production. According to BP Statistical Review of

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[5] Zharov Y.N., Meiton E.S., Sharova I.G. Valuable and toxic elements in marketable coals of Russia. // Reference book, «Nedra», Moscow, 1996. P.96-140 (In Russian).

[6] Millman, A., Tang, D., Perera, F.P. Air pollution threatens the health of children in China // Pediatrics. – 2008. – Vol.122. – P.620-628.

World Energy, as of 2016 Kazakhstan ranks eighth in the world in terms of proved coal reserves (33.6 billion tonnes, or 3.8% of the world's total). In coal production in the Republic of Kazakhstan, starting from 2013, there has been a reduction in the rate of up to 5% per year. According to the KAZENERGY-2015 National Report, coal is expected to be partially replaced by other energy sources (natural gas and nuclear capacities) after 2020. By 2030, the share of coal in the energy sector is expected to decrease to 50% (from the current 66%) and almost to 40% in 2040. According to the Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan, the volume of coal production in 2016 amounted to 98.0 million tons (96.5% to the plan).

There are 25 coal companies operating in the country in the field of coal mining. The main coal mining companies are located in the Karaganda, Ekibastuz and Maikuben coal basins, as well as in the Shubarkul, Burlin and Karazhyr deposits. The coal industry accounts for more than 70% of Kazakhstan's electricity generation, almost one hundred percent of coke and chemical production, and fully satisfies the fuel needs of the domestic sector and the population. The production of electricity in Kazakhstan is carried out by 128 power plants of various forms of ownership. As of 01.01.2018, the total installed capacity of Kazakhstan's power plants is 21,672.9 MW, and the available capacity is 18,791.4 MW. Electric power plants are divided into national power plants, industrial power plants and regional power plants. Power plants of national importance include large thermal power plants, which ensure generation and sale of electricity to consumers in the wholesale electricity market of the Republic of Kazakhstan: «Ekibastuzskaya SDPP-1» LLP named after B.G. Nurzhanov; «Ekibastuzskaya SDPP-2» JSC; ERG, power plant «EEK» JSC; «Eurasian Group»; SDPP «Kazakhmys Energy» LLP, and «SDPP Zhambylskaya» JSC named after T.I. Baturov. Industrial power plants include cogeneration plants with combined generation of electricity and heat, which are used to supply electricity and heat to large industrial enterprises and nearby communities, for example, TPP-3 «Karaganda Energocenter» LLP, TPP PVS, TPP-2 of «Arcelor Mittal Temirtau» JSC, TPP of «SSGPO» ERG JSC, «Eurasian Group», Balkhash TPP, Zhezkazgan TPP of «Kazakhmys Energy» LLP, TPP-1 of «Aluminium of Kazakhstan» ERG JSC, Eurasian Group, etc.

Calculation of mercury inflow from the subcategory «Coal Combustion at Large Power Plants» is based on the data received from the enterprises in the course of the relevant requests.

The economic activity indicator is the amount of coal burnt, t/year.

Based on the recommended inventory approaches, a separate assessment by coal type should be made. In this regard, data were collected for each type of coal used in Kazakhstan: hard coal, brown coal (lignite) and anthracite. Coking coal was not included in the calculation as it is not used for heat and power generation. In 2016, 44,426,673 tons of hard coal and 3,426,121 tons of lignite were burned at the plants. Total of 47,852,795 tonnes of coal was burnt in Kazakhstan in 2016 to produce energy.

Mercury emissions from this subcategory were **1,436** kg of mercury per year.

It should be noted, however, that a mercury input factor of 0.03 g Hg/t of burnt coal was used in the calculation. Within the framework of conducting the 2nd level of inventory in the Republic of Kazakhstan, a laboratory study of the Kazakhstani angle was conducted. Within the limits of the given research 6 samples of coal samples were taken from the main deposits of the Republic of Kazakhstan: 1) Ekibastuz («Bogatyr» mine – Bogatyr Komir LLP and «Severny» mine – «Severny mine» LLP), 2) Bayanaul district of Pavlodar region (Maikuben basin – «Maikuben West» LLP), 3) Karaganda region, Karaganda (Shubarkolskoye coal field – «Shubarkol Komir» JSC), 4) Zhana-Semey district of East Kazakhstan region («Karazhyra» coal field – «Karazhyra LTD» LLP), 5) Osakarovskiy district of Karaganda region (Borlinskoye field – «Karagandaugol»).

Then, the selected coal samples were sent to the SGS Novokuznetsk laboratory. Thus, in the course of this study it was obtained that the Kazakhstan coal contains from 0.02 to 0.04 g Hg/t (Table 6).

Table 6 – Level of mercury content in Kazakhstan coal

Coal field	№ sample	Unit of measurement	Content (dry condition)	Unit of measurement	Content (dry condition)	Testing method
«Bogatyr» mine, LLP «Bogatyr Komyr» (Ekibastuz)	0001	%	0,000004	ppm	0,04	State Standard 32980-2014 (ISO 15237:2003)
«Severny» mine, LLP «Mine Severny» (Ekibastuz)	0002	%	0,000004	ppm	0,04	State Standard 32980-2014 (ISO 15237:2003)
Maikuben coal basin, LLP «Maikuben West» (Bayanaul district, Pavlodar region)	0003	%	0,000002	ppm	0,02	State Standard 32980-2014 (ISO 15237:2003)
Shubarkul coal field, JSC «Shubarkul Komir» (Karaganda region)	0004	%	0,000002	ppm	0,02	State Standard 32980-2014 (ISO 15237:2003)
«Karazhyra» coal field, LLP «Karazhyra LTD» (Zhana-Semey district, East Kazakhstan region)	0005	%	0,000004	ppm	0,04	State Standard 32980-2014 (ISO 15237:2003)
Borlinskoye coal field, «Karagandaugol» (Osakarovka district, Karaganda region)	0006	%	0,000004	ppm	0,04	State Standard 32980-2014 (ISO 15237:2003)

Average coefficient (0.03 g Hg/t) was used in the calculations. Thus, the mercury content of Kazakhstani coals is significantly lower than the average mercury content of other hard coals.

It should be noted that the Republic of Kazakhstan does not have official data on mercury content in coals of different basins. The mercury content is not included in the mandatory indicators characterizing the safety of coals and products of their processing, respectively, mercury is not measured when issuing the relevant certificate of conformity for products.

2.3.2 Other ways of coal using

This subcategory covers smaller-scale coal fired power plants (typically with a boiler output of less than 300 MW), including other combustion plants and boilers, the use of coal and coke in the home for space heating and cooking, and the production and use of coke (from coal) for other needs, such as metallurgical processes.

Taking into account the calculation of mercury input within the framework of «coal combustion at large power plants», this subsection includes non-fuel use of coal.

The main consumers of coke in Kazakhstan are mining and metallurgical enterprises. The existing coke production in the country does not meet the necessary requirements, so coke is imported from the Russian Federation and the People's Republic of China. All balance reserves of coking coal are located in Karaganda region.

According to the data received, in 2016, 9,148,564 tons of coal was used for coke production in Kazakhstan. The default input factor was based on the survey conducted under Tier

2 of the inventory and was 0.03 g of mercury per 1 tonne of coal. Mercury input from this source category was **274** kg of mercury per year.

2.3.3 Extraction, treatment and use of oil and petroleum fuel

The mercury content in crude oil and gas varies significantly. In order to obtain accurate estimates of the total amount of mercury mobilized from oil and gas, it is necessary to obtain large amounts of samples from major oil and gas fields. In addition, the amount of mercury contained in crude oil refined at different refineries may differ. As a starting point for determining the mobilization of mercury in oil and gas use, its distribution in oil and gas feedstock needs to be considered in the geological context. The vibration limits of mercury content in oil and gas feedstock are very significant. These fluctuations are caused by geological reasons and the main of them is the confinement of mercury-containing deposits to the zones of regional faults of mantle deposits, on which mercury in the composition of fluids (mercury degassing of the Earth) goes to the zones of gas, oil and ore formation and participates in these processes.

This subcategory covers the extraction, refining and use of oil, and includes the extraction, processing and combustion of oil and petroleum products to produce electricity, heat, transport fuels and other uses such as asphalt (bitumen), chemical synthesis, polymers, lubricants and industrial soot (black pigments). Similarly to other natural materials, oil fuels contain small amounts of mercury impurities that are mobilized into the biosphere during extraction and use. Mercury concentrations in oil can vary widely, depending on local geological conditions. In addition to the mercury contained in the oil itself, certain types of drilling fluids are another input for mercury in oil extraction. Although drilling fluids are indicated to contain mercury, data are not available for this methodology to quantify these inputs.

The most important factors determining emissions from oil combustion sources are the mercury content of the feedstock and the amount of fuel combusted. The main pathway for allocating emissions from these sources is to air emissions. Because all fuel supplied is exposed to high flame temperatures, almost all mercury from the fuel is transferred to the gaseous phase and removed from the furnace with the combustion gases. If these gases are not cleaned in low-temperature air pollution control systems and in high efficiency particulate filters, which are not normally installed in this type of equipment, mercury is emitted in the vapour phase through the chimney.

The calculation of mercury inputs from this subcategory includes the extraction and processing of crude oil, the use of fuel oil, oil and shale coke, oil and shale bitumen, crude oil, aviation and motor gasoline, jet fuels such as gasoline and kerosene, kerosene and gasoil directly as fuel or energy.

Due to the different mercury content of petroleum products, the subcategory was broken down into several components with corresponding default input factors: oil production and refining (0.0034 g/t); combustion/use of oil scythe and heavy fuel (0.02 g/t); combustion/use of diesel fuel, gasoline, oil and kerosene (0.002 g/t).

Outlet Distribution Factors: The main emission pathway from these sources is emissions to the atmosphere and the special treatment/disposal sector.

Confirmed oil reserves in the Republic of Kazakhstan amount to about 4.8 billion tons. These reserves make up about 2% of the world's oil reserves and allow the country to be among the 12 leading countries in the world in terms of oil reserves. At the same time, promising oil reserves in the country are estimated at 17 billion tons.

Oil and gas bearing regions occupy 62% of the country's territory and have 252 oil fields, of which about 130 are under development.

More than 90% of oil reserves are concentrated in 15 major fields. The fields are located in the following regions of Kazakhstan: Aktobe (Zhanazhol, Kenkiyak, Alibekmola), Atyrau (Tengiz, Kashagan, Tsentralno-Vostochnaya Prorva, Kenbai, Korolevskoye) fields, West Kazakhstan (Karachaganak), Karaganda (Kumkol) and Mangistau (Uzen, Zhetybai, Kalamkas,

Karazhanbas and Northern Buzachi) regions. At the same time, approximately 70% of hydrocarbon reserves are concentrated in western Kazakhstan.

According to the data received from the enterprises, in 2016 the Republic of Kazakhstan produced 60,410,439 tons of crude oil and 25,480,385 tons of oil was processed at refineries. The default coefficient of 0.0034 g/t was used to calculate the mercury inflow from this source category. Thus, oil extraction and processing was the source of **292** kg of mercury per year.

This subcategory also includes the use of heavy fuel and fuel oil for combustion as fuel and other needs for its use.

In 2016, 847,465 tons of heavy fuel and fuel oil were burned, while 130,167 tons of fuel were used for other purposes. The recommended input factor of 0.02 g/t was used in the calculations. Thus, the use of heavy fuel and fuel oil brought **20** kg of mercury.

The main fuel for cars in the Republic of Kazakhstan is gasoline, some cars are filled with diesel fuel, which is mostly applicable for commercial vehicles. In addition, liquid fuel is actively used for space heating and other industrial needs.

In 2016, 23,505,538 tonnes of fuel were used for refuelling vehicles, and 64,160,279 tonnes of fuel were used for heating and other purposes. The recommended input factor of 0.002 g/t was used in the calculations. The total yield of mercury in this category was **175** kg of mercury per year.

Thus, the receipt of mercury from the source category «Extraction, treatment and use of oil and oil fuel» amounted to **487** kg of mercury per year.

At the same time, it is necessary to take into account that national mercury inlet coefficients are not defined for oil. Current methods for calculating pollutant emissions do not include the calculation of mercury emissions from industries where mercury is not directly used or applied in production processes.

2.3.4 Natural gas extraction, treatment, transportation and use

Natural gas is a fossil fuel that is extracted, processed and used for a variety of purposes, primarily for combustion to produce electricity and heat. Like many other materials of natural origin, natural gas contains small amounts of mercury impurities that are mobilized into the biosphere during extraction, processing and use. Natural gas produced in some regions contains significant concentrations of mercury (depending on geological conditions). Mercury emissions may occur during the extraction, processing, treatment and use of gas. In some countries, mercury from gas treatment residues («condensate» or waste from a special mercury filter) is recovered and marketed as a by-product. In other countries, these residues are collected and treated as hazardous waste. In offshore gas production, the primary gas treatment processes are sometimes carried out directly at the extraction site and the water discharged directly at the extraction site may be used in these processes. The mercury content of natural gas is still not fully understood. This can be considered a major data gap in the description of mercury emissions. In most countries, the gas supplied to consumers is treated and contains only a small amount of mercury at this stage.

Most of the mercury contained in natural gas feedstock can be removed during mining and/or processing, including hydrogen sulphide removal, so natural gas can be considered as a whole as a clean fuel containing mercury in very low concentrations.

Since the gas supplied to consumers by pipeline is already of marketable quality, the mercury concentrations in such gas are usually very low, so it is separated into a separate line of calculation.

The mercury inlet factor for natural gas fed through the pipeline is based on an average gas value of 0.22 μg/m3, for pre-treated gas and for natural gas extraction and treatment of 100 μg/m3. Output factor – in different environments.

For mineral resources of the Republic of Kazakhstan, recoverable gas reserves are approved at the level of 3.9 trillion m3, including associated gas – 2.6 trillion m3 and natural (free) gas – 1.3 trillion m3.

Meanwhile, according to one of the world's recognized sources of industry information – British Petroleum – gas reserves in Kazakhstan amount to 1.3 trillion m3, which allows the Republic of Kazakhstan to take the 22nd place in the world and the 3rd place among the CIS countries after Russia and Turkmenistan. This discrepancy is caused by the high share of associated petroleum gas in the gas reserves of the Republic of Kazakhstan, as well as differences in the methods for calculating reserves, according to which the country plans to implement the transition to international standards in the near future.

The main share of natural gas production is provided by large fields – Karachaganak (49%), Tengiz (31%) and Kashagan (14%). In the future, with the production of liquid hydrocarbons, these large oil and gas fields will gradually move into the gas category, which provides for greater gas production.

Natural gas production is secondary to oil production in Kazakhstan. The main part is produced in parallel with oil (associated gas or condensate gas). In the country, about 40% of the produced associated gas is injected into the reservoir to maintain pressure, and therefore only about 60% of gross gas production can be directed to commercialization to consumers.

According to the data provided by the companies, natural gas production in 2016 amounted to 39,560,832,094 m3. The use of untreated or pre-treated gas amounted to 1,845,949,617 m3. 50,646,793,471 m3 of cubic natural gas was transported by pipeline.

The mercury inlet factor for natural gas fed through the pipeline is based on an average gas value of 0.22 μg/m3. For pre-treated and natural gas production and processing – 100 μg/m3.

Thus, the inflow of mercury into the environment as a result of extraction and processing of natural gas amounted to **3,956** kg per year, as a result of the use of untreated or pre-treated gas – **185** kg per year, as a result of transportation of gas through the pipeline – **11** kg.

In total, the mercury supply from the source category «Extraction, treatment, transportation and use of natural gas» amounted to **4,152** kg of mercury per year.

2.3.5 Shale oil burning

This subcategory includes the extraction and use of other fossil fuels such as peat (which is a form of very young coal) and oil shale. The latter is the type of shale from which dark crude oil can be distinguished by distillation. Like other fossil fuels and non-fossil fuels, they may contain traces of mercury that can be mobilized in mining and combustion.

According to the data received, 1,327,003 tons of oil shale was burned in Kazakhstan in 2016.

The mercury inlet factor of 80 mg Hg/t was used in the calculation.

Thus, the input of mercury from the «Oil shale burning» source category was **106** kg of mercury per year.

2.3.6 Energy and heat production by burning biomass

In many countries and regions, electricity and heat production is largely based on biomass combustion. These sources burn wood: branches, bark, sawdust, wood shavings, etc., peat or agricultural waste (straw, citrus waste, shells, poultry droppings and camel excreta). Wood waste is used as industrial fuel. In the residential sector, wood is used to burn wood stoves and fireplaces. In the residential sector, wood is used to burn wood stoves and fireplaces. In this methodology, sources in this subcategory include wood boilers and other types of biomass boilers, wood stoves, fireplaces, and other biomass combustion installations. For boilers, it is assumed that properly operated and maintained steam turbine generators are used to provide the maximum output power. This section does not cover burning of contaminated wood. Biomass is actively used for heating and cooking in the residential sector in many countries. In most cases, however, it is wood, and other biofuels can also be used. Biomass for heating residential buildings and cooking is burnt in a wide range of systems, from small open pits and fireplaces to large complex stoves and wood-burning stoves. Biomass burning for home heating and cooking takes place in systems with higher

combustion efficiency than the higher the gross national product and the level of development of the country.

The most important determinants of mercury emissions are the type and quantity of biomass burnt and the concentration of mercury in it. Mercury in biofuels can be of natural or anthropogenic origin. For example, trees (especially needles and leaves) accumulate mercury from the atmosphere over time. When wood and other biomass are burnt, such mercury is mainly emitted to the atmosphere. Emissions of mercury from wood and other biomass can be significant in some countries. It is assumed that the majority of the Hg content of biomass is emitted to the atmosphere during the burning process. Less Hg is transferred to ashes or residues, the degree of transition depends on the specific material to be combusted, the type of device to be combusted, and the availability of emission control systems.

The default input factor of mercury for charcoal combustion is 0.12 g/t; the default input factor for biomass power plants is 0.03 g/t (not taken into account, as such power plants are not represented in Kazakhstan). Output factor is the main way of mercury ingress – atmospheric air.

Taking into account the small amount of biomass used as fuel, this category of mercury sources was not taken into account in the inventory.

2.4 Primary (virgin) metal production data

Mercury, which is present as a natural admixture in polymetallic ores, can enter the environment during mining and processing of raw materials and concentrates in metallurgical plants.

This category is divided into several subcategories:

1. Industrial production of metals:

- mining and processing of mercury-containing raw materials;
- mining and processing of gold through the mercury amalgamation process and other known methods;
- production of non-ferrous metals (zinc, copper, lead, aluminium) and ferrous metals (iron).

2. Other large-scale material production related to mercury emissions:

- cement production;
- production of pulp and paper.

Ferrous metal production is considered a major source of mercury emissions because it uses large amounts of coal and iron ore that contain trace amounts of mercury impurities[7]. Important determinants of mercury emissions from this category are the initial concentration of mercury in the ore/concentrates, as well as the amount of ore/concentrates processed, the technologies used to clean up the dust and gas emissions and the subsequent production of associated mercury.

Kazakhstan's mineral resource base is diverse and rich in mineral resources, which allows the country to occupy a leading position in the group of world countries. On the basis of proven reserves, the oil and gas, uranium and coal industries, mining industry for the extraction and processing of ferrous, non-ferrous and precious metals and other types of non-metallic minerals are created.

The mineral and raw material complex is of strategic importance for the country, as it makes up to 70% of GDP and most of the foreign currency earnings. As a result of sale of extracted mineral raw materials and products of their processing, the state budget is regularly replenished with impressive amounts.

The share of Kazakhstan in the world uranium reserves is 12%, chromium – 48% to lead – 14%, zinc – 12%, silver – 6%, manganese – 5%, copper – 4.3%. Kazakhstan is a major exporter

[7] Naomichi Fukuda, Masaki Takaoka «Mercury emission and behavior in primary ferrous metal production»

of energy raw materials, ferrous, non-ferrous and precious metals. In particular, Kazakhstan accounts for about 40% of the world's uranium output and about 16% of chromium.

The State balance of the Republic of Kazakhstan approved reserves of 102 types of minerals, including ore minerals (metal) – 36, non-metallic – 50, salts – 5, groundwater – 3 (fresh, brackish water, healing and mineral mud).

Ferrous and alloying metals. Kazakhstan has significant resources of ferrous metals, sufficient for sustainable development of the industry for a long time. The state balance sheet includes 73 iron ore reserves. The basis of the iron resource base is formed by skarn deposits with high-quality magnetite ores and brown-and-iron deposits concentrated in the Torgai region of Northern Kazakhstan. In addition, the source of ferrous metals is the deposits of the Karaganda region – Kentobe, Atasu.

Non-ferrous metals. The main **copper** reserves are concentrated in East and Central Kazakhstan (82%), with the remaining 18% unevenly distributed throughout Kazakhstan. (out of 108 facilities in subsoil use – 70). The raw material base of the industry in Ore Altai is gradually shrinking. One of the main problems is the lack of reserve large deposits at operating mining enterprises. Availability of their copper reserves prepared for operation is 10-12 years.

In recent years, the development of copper-porphyry ores at large deposits of Aktogay, Aydarly (2015e) and Bozshakol (2016) has begun.

It should be noted that there are no pure **lead** deposits in nature. Lead and zinc are usually found together and are represented by complex lead-zinc ores in deposits of various geological and industrial types. In Kazakhstan, the **lead-zinc** ore deposits under development are located in Karaganda and East Kazakhstan regions. High efficiency of their development is achieved due to the integrated use of ores with the extraction of lead, zinc, copper, gold and some associated rare metals.

The main problems of the lead-zinc industry of operating mining enterprises are the lack of reserve deposits with active balance reserves. At the same time, the reserves of the developed deposits do not exceed 10-15 years. Due to the low content of basic metals, a number of deposits located in different regions of Kazakhstan are not developed today (out of 86 objects in subsoil use – 48). Over the past 20 years, the prospects of discovery of new deposits of lead and zinc with high content of useful components have not been justified.

The basis of the country's **aluminium** industry is made up of low-grade bauxite deposits in the East Torgai region, which are processed at the Pavlodar aluminium smelter. Improvement of the technology of processing of low-grade bauxites will allow to expand the mineral resource base of the aluminium industry due to the explored deposits (out of 28 objects in subsoil use – 12), extending the term of the plant for more than 35 years. In addition, the prospects for the development of the mineral resource base of the aluminium industry are currently associated with the deposits of nepheline and nepheline leucite rocks, as well as alumina secondary quartzite.

Precious metals. The gold ore industry of the country as a whole is provided with balance reserves of gold-bearing ores taking into account the achieved productivity of mining enterprises for the period of up to 30 years for the largest enterprises (out of 272 balance objects in subsoil use – 160).

The domestic gold mining industry is characterized by the predominance of small and medium-sized deposits, low metal content in the ore, as well as the presence of a significant proportion of hard-to-concentrate ores. Many large deposits concentrate gold in hard ores containing arsenic and antimony. The removal process complicates ore processing technology and requires additional environmental protection costs.

It should be noted that gold mining companies produce only one third of the gold, while the other two thirds are in the copper and lead-zinc industries, where gold is a by-product of production.

The choice of the technology of processing of gold-bearing ores depends on its initial content, the size of inclusions in the rocks and other factors.

Oxidized gold-bearing ores are processed by heap leaching. Primary ores are enriched at the gold extraction plant by a complex gravitational-hydrometallurgical scheme. The main ore minerals of primary ores are such sulphides as pyrite, chalcopyrite, faint ores, sphalerite, galena, pyrrhotite, which are found in insignificant amounts in the main mass of ores. Mainly the technology of processing of such ores includes combined methods – gravitation and flotation enrichment with subsequent sorption cyanidation of gold-containing product, gold desorption from saturated coal and electrolysis of eluates with subsequent melting of precipitate and production of Dore alloy.

2.4.1 Mining and processing of zinc ores and concentrates

As noted above, there are no pure lead and zinc deposits in the country. Both metals are represented by complex ores – lead-zinc ores of various geological and industrial types. In sulphide ores these metals are present together: lead minerals – galena or plumoyarozite, zinc is usually in the form of sulphide mineral – sphalerite, less often – wurzite, zincite, etc. Cadmium, bismuth, which can be accounted for in the balance sheet of the deposit are related.

Mercury is usually present as a lubricant and its content is determined by atomic absorption spectroscopy, X-ray spectra and atomic emission analysis when calculating mineral reserves. According to numerous results of analyses of mono-mineral sulphide fractions and mineralogical studies of ores of various deposits, it has been established that only sphalerite – zinc sulphide – can be the main carrier of mercury.

The extracted lead-zinc ore is crushed, crushed and subjected to flotation enrichment. Depending on the composition and technological properties of the ore, lead and zinc concentrates are most often produced from it. Ores containing copper, tin or barite are also used to produce copper, tin and barite concentrates.

Today, the main producers of lead and zinc-based non-ferrous metals are «Kazzinc» JSC (which includes the Ridder Zinc Plant) and «Yuzhpolymetal» JSC. Lead, zinc and copper concentrates are supplied to Ust-Kamenogorsk Iron and Steel Works, where they are also used to extract silver, cadmium, selenium, tellurium, indium and mercury. Sulphide is captured for the production of sulphuric acid.

The technological scheme of refined lead production includes ISASMELT melting – mine melting – refining.

The technological scheme of zinc metal production includes roasting of zinc concentrates, cinder leaching, two-stage cleaning, electrolysis of zinc solutions and melting of cathode zinc.

It is clear that the mercury impurities pass through the entire process and are usually removed with the dust and gas stream captured by the treatment plants. In addition, mercury is partially captured in the dust and partially transferred to the sulphuric acid plant when cleaning the waste gases. Here, the mercury is concentrated in the sludge in the washing room.

At the lead plant of the Ust-Kamenogorsk metallurgical complex, these sludge from the washing towers of the sulfuric acid plant is processed according to the technological scheme: preparation of sulphide slurry, cementation of mercury in the apparatus, chemical and vacuum refining of metallic mercury. The volume of production of mercury is 12 tons per year.

Thus, in the lead-zinc industry, mercury emissions into the atmosphere and aquatic environments depend to a greater extent on the condition of treatment plants, into the soil environment on the volume of industrial waste (unused pyrite product, sludge and other solid waste).

Balance reserves of zinc in the subsoil of Kazakhstan amount to 31 million tons, lead – 15.4 million tons. The state balance sheet accounts for 93 zinc deposits and 96 lead deposits. These metals occupy the 3rd place in the world by confirmed reserves.

«Kazzinc» JSC is the main producer of zinc and lead in Kazakhstan. It accounts for more than 90% of the zinc and lead metal production in Kazakhstan. Metal zinc is produced at two zinc plants of Ust-Kamenogorsk and Ridder metallurgical complexes, and refined lead – at lead plant of Ust-Kamenogorsk metallurgical complex. Kazakhstan exports the main volumes of produced

metals (85-88% in recent years), the main importers of ore and concentrates – Russia and Uzbekistan, raw zinc – China and Turkey.

The indicator of economic activity used to calculate the mercury from zinc production is «used beneficiation product», i.e. the volume of zinc concentrate, which amounted to 646,900 tons in 2016. The default input factor was 65 g/metric tonne of concentrate. Thus, the volume of mercury emissions into the environment due to the production of zinc concentrate in 2016 amounted to **42,049** kg.

2.4.2 Mining and processing of copper ores and concentrates

Copper ores of Kazakhstan (mainly sulphide ores) contain insignificant amount of mercury in the form of an admixture element. When calculating mineral reserves, the main method of research on impurities is atomic absorption spectroscopy, X-ray and atomic emission analysis.

Further on, chemical and mineralogical analyses are carried out to determine the quantitative content and relationship of impurity elements with the main minerals of ore raw materials/concentrates.

According to numerous results of analyses of mono-mineral sulphide fractions, as well as mineralogical studies of ores of various copper-containing deposits, it has been established that the main carrier minerals of satellite elements are sulphide minerals. It has been established that increased concentrations of selenium, tellurium and bismuth are more often found in copper sulphide minerals; cadmium and mercury are found in sphalerites; silver, bismuth, arsenic and antimony are found in faint ores; silver, bismuth and tellurium are found in galena; selenium, arsenic and antimony are accumulated in pyrites. That is, in ores of copper deposits of mercury can be present at presence in a greater degree of zinc mineral – sphalerite.

The technology of processing copper and copper-polymetallic ores includes the stages of grinding and selective or collective selective flotation, which produces copper concentrate, and in the case of polymetallic raw materials – lead and zinc concentrates. The temperature in the ore processing cycle at the concentrators is low (less than 100C), so mercury is almost never released into the atmosphere. The largest amount of mercury is concentrated in pyrite product (iron sulphide, prevailing by weight) and in zinc concentrate.

The metallurgical process of copper production includes the process of copper concentrate smelting, electric smelting-converting-burn refining and electrolysis. Concentrates of various origins – obtained from pure copper ore and polymetallic raw materials – are processed, so it is clear that the impurities of mercury content go through the entire process and are usually removed from the dust and gas stream captured by the treatment plants. In addition, mercury is partially captured in the dust and partially transferred to the sulphuric acid plant when cleaning the exhaust gases. Here, in the washing room, mercury is concentrated in the sludge, which is most often stored in the copper industry in the waste dumps.

Thus, in the copper industry, mercury emissions to the atmosphere and aquatic environments depend to a large extent on the condition of the treatment plants, and to the soil environment on the volume of industrial waste (unused pyrite product, sludge, etc.) stored in landfills.

The state balance sheet takes into account the reserves of copper in 125 deposits. Total copper reserves amount to 40 million tons. The main geological and industrial types of copper and copper-containing complex deposits, where 90% of copper reserves are concentrated, are represented by the following types: copper-porphyry – 60%, cuprous sandstones – 14%, pyrites-polymetallic – 9% and 7% copper-quantitative type.

The largest copper producer in Kazakhstan, and one of the world's leading producers, is «Kazakhmys Corporation» LLP (Balkhash and Zhezkazgan smelters in Balkhash and Zhezkazgan respectively) and «KAZ Minerals», which also processes concentrate at the Balkhash smelter. They account for over 70% of Kazakhstan's copper production. Copper production is fully integrated, from ore extraction to the production of finished copper cathode and rod products. «Kazzinc» receives by-product copper. In Aktobe, the «Aktobe Copper Company» LLP, part of

the «Russian Copper Company», mines and produces copper. The Company's business includes the mining, processing and production of copper in the form of copper cathodes and copper rods, as well as copper concentrate. In addition, zinc concentrate, gold and silver are produced. In addition, «Casting» LLP (Almaty) has the capacity to produce refined copper from secondary raw materials.

Calculation of mercury inflow is based on the economic activity indicator – «used beneficiation product» (copper concentrate), which amounted to 10,502,900 tons in 2016. The default input factors for mercury are 30 g/tonne of concentrate per metric tonne.

Thus, the volume of mercury emissions into the environment from the sub-category «Extraction and production of copper» in 2016 amounted to **315,087** kg.

2.4.3 Mining and processing of lead ores and concentrates

Lead is extracted from sulphide ore, mainly galena (lead sulphide), which also contains some mercury. The mercury content of ores varies, and in some cases may be increased compared to other natural raw materials.

The main steps in lead extraction are usually similar to the «pyrometallurgical» extraction process described for zinc, and include the production of copper-rich concentrate from raw ore, concentrate roasting and smelting – reducing the metal oxide in the furnace that occurs at high temperatures. At some production facilities, concentrate is not sintered before it is introduced into the kiln. In this case, most of the mercury present in the concentrate is expected to evaporate and is accompanied by gas flows through the subsequent stages of the process. As with zinc and copper, mercury present in the exhaust gases from sintering and smelting can be removed at a separate stage of mercury removal before the gases are discharged into the sulphuric acid regeneration plant (if available). Lead is sometimes produced in conjunction with zinc or other non-ferrous metals.

The main factors determining the pathways and yields of mercury from lead mining and extraction are virtually all media, as for the other non-ferrous metals discussed above. The concentration of mercury in the ore/concentrates, as well as the amount of ore/concentrates used, the treatment technologies used and the production of associated mercury are important determinants of mercury emissions.

Kazakhstan's proven lead reserves are estimated at 11.7 million tonnes (or 10.1% of global reserves), ranking the Republic 6th after Russia, Australia, Canada, the United States and China. Kazakhstan's lead reserves are concentrated in more than 50 deposits, and lead-bearing ores are mined in 5 deposits. Most of the lead produced in Kazakhstan is produced by «Kazzinc». Kazakhstan exports the overwhelming amount of lead produced.

The indicator of economic activity is «used enrichment product», t/year. In 2016, the production of lead concentrate amounted to 370,600 tonnes.

The default input factor for mercury is 30 g/metric tonne of concentrate.

Thus, the volume of mercury emissions into the environment from the sub-category «Lead mining and initial processing» in 2016 amounted to **11,118** kg.

2.4.4 Gold mining and primary processing in ways other than mercury amalgamation

Own gold deposits can contain mercury in clark fractions, in the form of oxides, and sometimes in native form. However, due to its low content (less than 0.001%), it is not taken into account when calculating gold reserves and, accordingly, is not included in the state balance sheet. Polymetallic gold ore may also contain an insignificant concentration of mercury (less than 0.001%), the most common mineral being cinnabar (mercury sulphide); especially if the ore has a high content of zinc sulphide (sphalerite), which is most commonly used as a carrier of mercury. But even in this case mercury is not put on the balance of the deposit.

In cyanide technology for processing gold ores/concentrates, the presence of mercury may adversely affect the cyanide-sorption process for gold recovery. Improvements in the process through the use of special methods of removing mercury from the main process of cyanide leaching

of gold allows the transfer of mercury into the hard-soluble sediment of mercury sulphide, which is stored in special storage facilities.

Thus, mercury and its compounds can be processed as an impurities component or recovered as a by-product of gold ore.

The state balance of mineral resources of Kazakhstan includes 343 gold deposits, of which 285 deposits fall on the share of primary, 43 – alluvial and 15 – manufactured mineral formations. In terms of proven reserves and production, Kazakhstan is one of the world's major gold producers, ranking 14th.

Gold deposits have been identified in all regions of Kazakhstan, but the leading position in terms of reserves is held by Eastern, Northern and Central Kazakhstan (85%). Gold and gold deposits are localized in 16 mining areas, the most important of which are: Kalbinskiy and Rudno-Altaiskiy deposits in Eastern Kazakhstan (Bakyrchik, Bolshevik, Ridder-Sokolnoye, etc.); Kokshetauskiy and Zholymbet-Bestobinskiy deposits in Northern Kazakhstan (Vasilkovskoye, Zholymbet, Bestobe, etc.); Kokshetauskiy and Zholymbet-Bestobinskiy deposits in Northern Kazakhstan (Vasilkovskoye, Zholymbet, Bestobe, etc.); Shu-Ili and Dzungarian in South Kazakhstan (Akbakai, Beskempir, Archarly, etc.); Maikainskiy and Severo-Balkhashskiy in Central Kazakhstan (Maykain, Boschekul, Sayak IV, Dolinnoye, etc.); Zhetygarinskiy and Mugodzharskiy in Western Kazakhstan (Zhetygara, Komarovskoye, Jubilee, etc.).

From the geological point of view, the main geological and industrial types of gold deposits in Kazakhstan are: quartz-core, stockwork, mineralized zones, complex (copper, pyrites-polymetallic). Exogenous deposits (placers and gold-bearing weathering crust) account for about 2% of active reserves. About 40% of the gold mined is from the pyrites-polymetallic deposits developed by «Kazzinc» JSC and «Kazakhmys Corporation», from which gold is extracted as a by-product component.

The main method used to process gold-containing ores to produce gold-containing concentrates is ore preparation with further application of complex enrichment schemes, including gravity, cyanide and flotation methods. The use of amalgam gold extraction by large enterprises is completely discontinued as economically inefficient. Therefore, «gold mining through the mercury amalgamation process» is not addressed in this report.

However, the illegal and therefore difficult to control use of mercury in small artisanal miners is still used, although it is not known how widespread it is. According to information sources, gold mining from illegally mined ore is not only amalgamation.

At the same time, it should be noted that the use of mercury in the Republic of Kazakhstan is subject to strict control and reporting by the authorized state body, while illegal trafficking of toxic substances that are not precursors to which mercury belongs, as well as its smuggling, is regulated by the Criminal Code of the Republic of Kazakhstan. In this regard, it can be assumed that the use of mercury for gold extraction is currently not widely used in Kazakhstan.

Based on the above, only the subcategory «gold mining by methods other than amalgamation of mercury» was taken into account. To calculate the inflow of mercury from gold mining, we used the economic activity indicator – used gold ore, the volume of which in 2016 was 18,773,300 tons.

The default mercury input factor for gold mining without mercury amalgamation processes was assumed to be 15 g/metric tons of ore.

Thus, the volume of mercury emissions into the environment from the sub-category «Gold mining and primary processing by methods other than amalgamation of mercury» in 2016 amounted to **281,600** kg.

2.4.5 Aluminium mining and production

The essence of the aluminium production process is to obtain anhydrous, free of impurities of aluminium oxide (alumina), followed by the production of metallic aluminium by electrolysis of dissolved alumina in cryolite.

Bayer sintering technology: After crushing, the bauxite is crushed in mills and the thick mass is then crushed to sinter with limestone and soda. Then the speck is loaded into an autoclave and processed with caustic soda to convert the entire aluminium oxide into a solution, and all foreign impurities turn into solid residue – red mud. The following operations are decomposition (separation of pure alumina) and electrolysis at 950 C to produce aluminium in pure metal form.

These processes lead to emissions into the atmosphere and the formation of waste material. In the process of hydrolysis, finely ground bauxite forms sludge with sodium hydroxide solution and lime, and interacts at high pressure and temperature to remove iron oxides and silicon oxides. Sodium aluminate is formed and silicon, iron, titanium, calcium and oxides form insoluble components of solid waste residue. During the hydrolysis process, the volatile organic components of the ore are released and released into the air in the form of uncontrolled discharges. During drying/penetration, coarse alumina is fired in rotary kilns or fluidized bed kilns at around 1000ºC. The kilns produce hot flue gases containing aluminium oxide and water vapour. The processing industry uses two types of furnaces: oxalate and alkali. Standard emission control equipment includes cyclone separators. Emission control equipment can also be used to recover products as well as to minimize emissions.

The main factors that determine the pathways and yields of mercury from aluminium mining and processing are virtually all environments, as are the other non-ferrous metals discussed above.

In Kazakhstan, balance reserves are accounted for at 27 deposits, of which five are exploited. Geographically and geologically, they are located in eight bauxite-bearing areas: West Torgai, Central Torgai, East Torgai (Amangeldinsk), Akmola, Ekibastuz-Pavlodar, Severo-Kokshetau, Mugodzhar and South Kazakhstan.

The bulk of the Republic's reserves (about 90%) are concentrated in fields located in the Kostanay region (West Torgai and Tsentralno-Torgai bauxite districts). The Torgai Bauxite Mine develops bauxites of the East Torgai group (Arkalyk, Severnoye, Nizhne-Ashutskoye, Verkhne-Ashutskoye, Ushtobinskoye fields). The Krasnooksyabrsky Bauxite Mine is a bauxite mine of the West Torgai group (Belinskoye, Ayatskoye, Krasnooksyabrskoye, Uvalinskoye and Krasnogorskoye fields).

«Eurasian Resources Group» is a leading aluminium producer. The aluminium division of the company is represented by «Aluminium of Kazakhstan», one of the world's leading alumina producers. The raw material base of the company is assessed as stable, the reserves of bauxite ores at the developed and prospective deposits are sufficient for the operation of the company for at least 50 years. Mined bauxites are sent to the Pavlodar aluminium smelter for processing.

The indicator of economic activity is «treated bauxites», t/year. In 2016, the volume of aluminium ore (bauxite) mined in the country amounted to 4,802,200 tonnes. Default input factors for mercury are 0.5 g/tonne of bauxite used in aluminium production.

Thus, the volume of mercury emissions into the environment from the sub-category «Aluminium mining and initial processing» in 2016 amounted to **2,401** kg.

2.4.6 Mining of ferrous metal ores and production of cast iron and steel

The only enterprise producing primary pig iron is «Arcelomittal Temirtau» JSC, located in Karaganda region. The main production facilities of the iron and steel works are coke-chemical, sinter-making, steel-melting and rolling mills.

The coke production facility produces coke from coking coal of the Karaganda coal basin. CCP includes chemical recovery shops and a coke shop. Coking produces the main product – coke and related – gas, resin, which are delivered to the shop of chemical recovery, rectification, resin distillation and workshops, where the corresponding chemical products are produced.

Sinter-making production includes a crushing and screening plant with an averaging warehouse, charge materials and sludge preparation areas, a sintering plant, a blast furnace shop and a slag processing plant. Raw materials are ores and concentrates of «Orken» LLP, as well as concentrate and pellets of «Sokolovsko-Sarbayskoye» mining and processing plant.

The blast furnace shop smelts pig iron and pig iron for the converter and shaped foundry shops. Gutters, where cast iron and slag are covered, and exhaust gases are collected and cleaned, and then released into the atmosphere. The steelmaking process includes an oxygen converter shop and 3 continuous casting lines. Rolling production includes a hot-rolling shop, two cold rolling shops and a hot-dip galvanizing and aluminating shop, as well as a polymer coating line.

Cast iron is produced from ore by means of reduction processes, which are carried out in the blast furnace. With the help of oxidation processes, cast iron is cleaned together with various amounts of filling from unwanted impurities. These process steps, called «cleaning», produce steel from cast iron and scrap.

Iron ore, chromite and manganese ores, coking coal, flux and refractory raw materials are the raw material sources of ferrous metallurgy in the Republic of Kazakhstan. The analysis shows that the raw material base of ferrous metallurgy has sufficient reserves, the development of which is able not only to ensure the effective operation of metallurgical enterprises of the country (JSC «ArselorMittal Temirtau», Aktobe and Aksu ferroalloy plants), but also to supply their products for export.

The main balance reserves of iron ores are concentrated in Kostanay and Karaganda regions. In both regions, the largest consumer is «ArcelorMittal Temirtau», whose iron ore department is represented by «Orken» LLP, which unites iron ore enterprises: «Lisakovo Mining and Processing Plant», «Atasuisk Mining and Processing Plant» (Kentubinskoye, Karazhalskoye), «Atansorskoye Mining Plant» (Atansore, Akmola region). In addition, «Metal Terminal Services» LLP (Shoyintas deposit) and «Bapy Mining» LLP (Bapy deposit) are engaged in mining and processing in Karaganda region.

In Kostanay region, the iron ore mining and processing enterprise is Sokolovo-Sarbai mining and processing association, which is a part of «Eurasian Resoruces Group» (ENRC). «Sokolovsko-Sarbai Mining and Processing Production Association» JSC accounts for more than 95% of Kazakhstan's iron ore raw materials. At the same time, the reserves of open-pit mining are more than 90 years old, including underground mining – more than 200 years.

The main iron ore mining divisions are Sarbaiskoye, Kacharskoye, Kurzhunkulskoye and Sokolovskaya mines. Iron Ore Processing and Iron Concentrate Production Division – Ore Treatment and Concentrating Plant (includes crushing, screening and magnetic concentrating complexes).

In addition, dolomite is mined by Alexeyevsky dolomite mine and limestone mining – Kyzyl-Zharsky limestone mine.

The main determinants of mercury emissions for this sector are the starting concentrations of mercury in various raw materials, especially ore/concentrate and lime, and the amount of ore/concentrates used. It is assumed that a significant proportion of the mercury remains in the tailings that are located at the landfills during ore processing. In the metallurgical process, agglomeration plants and blast furnaces are the main source of mercury input. The mercury distribution factor at the outlet is air (95%) and industrial waste (5%).

According to the applied methodology of mercury inventory, for convenience and in the absence of detailed information on agglomeration processes, data on mercury are processed as one process of obtaining cast iron blanks in the form of products. However, the subsequent process of oxygen conversion of cast iron is not considered or studied as a significant source of mercury.

When calculating mercury emissions, the indicator of economic activity is the «pig iron produced», t/year. In 2016, the output of cast iron was 3,595,090 tonnes.

Default input factor for pig iron production in pigs (agglomeration and blast furnaces): 0.05 g Hg/metre of pig iron produced in pigs.

Thus, the volume of mercury emissions into the environment from the sub-category «Mining and production of primary ferrous metal (pig iron)» in 2016 amounted to **180** kg.

The total amount of mercury entering the environment from the primary (native) metal production category in 2016 was **652,434** kg, or 95% of the total amount of mercury entering the environment. If all primary metal production is assumed to be 100%, then «Copper production

from enriched products» is 48.29% (315,087 kg), «Gold production by methods other than amalgamation of mercury» – 43.16% (281,600 kg), and other metals (production of zinc, lead, alumina and cast iron) account for the remaining 8.55% (55,747 kg) of mercury inputs.

2.4.7 Cement production

Raw materials used in cement production contain low concentrations of mercury. The origin of this mercury is the natural mercury found in the pure raw materials used (lime, coal, oil, etc.), in solids from other sectors (e.g. fly ash and coal combustion gypsum), where the mercury content may be higher than in pure materials, and in waste, sometimes used as a fuel in cement production. The use of waste, such as input material, can increase the overall input of mercury into cement production. The main pathways for the release of mercury from raw materials are air emissions and residual mercury levels in the cement produced. This sub-source category is a potential source of mercury emissions, which is a type that uses materials with very low concentrations of mercury, but in very large quantities.

The main raw materials (clay and lime) are extracted from quarries. The raw materials are brought to the plant and then mixed, crushed and ground to raw stone meal with the required particle size and chemical properties. There are four main types of cement production processes: dry, semi-dry, semi-wet and wet. In the dry process, the raw materials are ground and dried until stone flour is obtained, which is fed into a preheating or pre-fired furnace (or, less frequently, into a long-term drying furnace). The dry process requires 40% less energy than the wet process. In the wet process, the raw materials are ground in water to form a liquid slurry that can be pumped out by a pump and then fed directly into the kiln or first into the sludge drying process.

The pyrotechnic treatment (heat treatment) of the raw material is carried out in the furnace, which is the basis of the Portland cement production process. The pyrotechnic system consists of two or three steps: 1) drying or preheating (if applicable), 2) calcining (a heating process in which calcium oxide is produced) and 3) roasting (sintering).

After the drying or preheating stage, if used, the calcination process itself starts to produce cement, which is the decomposition of calcium carbonate (CaCO3) at approximately 900°C into calcium oxide (CaO, lime) and carbon dioxide (CO2).

After calcination, a sintering process is carried out in which lime, at a temperature of 1400-1500°C, reacts with silicon dioxide, aluminium oxide and iron oxide to form silicates, aluminates and calcium ferrites (also known as «clinker»). The final stage involves cooling the clinker. Once the hot clinker has been removed from the kiln, it is quickly cooled down in the cooler, for example, on a moving grate with fans underneath it that passes cold air through the clinker.

At the end of the process, the chilled clinker is ground together with the gypsum (CaSO4) into a fine powder and mixed with other additives to produce the final cement, which is stored in the bunker before being transported in bulk or packed. Mercury-containing dust from the air vents can be fed back into the process by re-entering the raw material preparation system (dry process), insulating the sintering area (wet kiln), or by feeding the dust into the final cement mixer (where cement production standards permit).

Relevant factors for determining mercury emissions may include: the amount of raw materials to be treated, the concentration of mercury in the raw materials, the amount of clinker and cement to be produced, the amount and types of fuel to be combusted, and the concentration of mercury in each of the fuels to be combusted in the plant.

In the Republic of Kazakhstan, cement production is carried out in five regions: Almaty, East Kazakhstan, South Kazakhstan, Zhambyl and Karaganda. The main problem of the majority of cement plants in the country is the use of outdated energy-consuming «wet» method of cement production, as well as depreciation of fixed assets.

The indicator of economic activity is «produced cement», t/year. In 2016, cement production amounted to 1,847,405 tonnes.

The default input factors for mercury are 0.11 g/t of cement produced.

Thus, in 2016, cement production in Kazakhstan became a source of **203** kg of mercury.

2.4.8 Production of pulp and paper

In the pulp and paper industry, wood pulp is produced from raw wood using chemical or mechanical means and a combination of both. The source of input of mercury is the residual levels of mercury in the raw wood material, in the fuel used for energy production and – most likely – in the chemicals used in processes (NaOH, chloride, and possibly others). Previously, the use of mercury-containing slimicide contributed to mercury emissions from pulp and paper production in the West. In the West, their use is discontinued or reduced, but may continue in other parts of the world. Atmospheric emissions from combustion processes using fossil fuels, bark, other wood waste and carbon-containing liquids (for processing chemicals and energy production), solid waste management and water emissions from processes are the main routes of release of mercury from pulp and paper production. This subcategory is a potential source of mercury emissions of a type where materials with very low mercury concentrations but in very large quantities are used.

The four main chemical pulping processes currently in use are (1) Kraft pulping, (2) Natrix pulping, (3) Kraft pulping and (4) Semi-Chemical pulping. In the Kraft pulping process, wood chips are «cooked» in an autoclave in a water solution of sodium hydroxide (NaOH) and sodium sulphide (NaS), which is called «cooking» or «white» liquor. Various processes (not described here) produce washed cellulose. The washed pulp can also be bleached before it is pressed and dried to produce the finished product. Some of the mercury contained in the wood shavings will be transferred to the finished product and the rest to the waste cooking liquor. Mercury levels in products and in liquor are expected to be relatively low because they are relatively low in wood chips. It is expected that the amount of mercury in the wood chips will be slightly different for different batches, depending on the origin of the wood being treated. Mercury emissions are associated with combustion systems located in the chemical recovery shop. The chemical recovery shop in the Kraft pulping plant includes chemical recovery furnaces, melt dissolving tanks and lime kilns.

Mercury can be introduced into the pulping process with wood for pulping, with water used in the pulping process, or as contaminants in the original chemicals. The concentration of mercury in wood and other input materials is an important factor in determining emissions.

If mercury is not removed from the wastewater or sludge process, it may accumulate in the area of chemical recovery and subsequently be released from chemical recovery combustion sources. The amount of mercury released may depend on the degree to which the pulping process is closed (e.g., the extent to which waste water is recycled and reused).

The output factor is mainly emissions to air.

According to the data, 350 tonnes of biomass were used for paper production in 2016. The economic activity indicator is «biomass used for production», tonnes/year. Default input factor for mercury is 0.03 g/t of biomass used for pulp production (per dry matter).

Thus, in the course of processing of biomass in 2016, **0.0105** kg of mercury was supplied to the environment.

2.5 Data on planned use of mercury in industrial processes

Mercury inputs to the environment are related to the use of mercury in production processes as a catalyst and in the manufacture of mercury-containing products.

According to the Methodology, this category considers the following subcategories:

1. Manufacture of chemical elements and polymers:

- chloride-alkali production using mercury electrolysers;
- production of VCM (vinyl chloride monomer) using mercury dichloride (HgCl2) as a catalyst;
- production of acetaldehyde using mercury sulphate (HgSO4) as a catalyst;
- other chemical and polymer production using mercury compounds as catalysts.

2. Manufacture of consumer goods containing mercury:

- mercury thermometers;
- electrical and electronic switches, contacts and relays using mercury;

- mercury-containing light sources;
- batteries containing mercury;
- polyurethane production with mercury catalyst;
- biocides and pesticides;
- paints;
- pharmaceuticals for humans and veterinary medicine;
- cosmetics and related products.

In the Republic of Kazakhstan there are no such subcategories of industry.

2.5.1 Manufacture of chemical elements and polymers

At the same time, earlier operating chemical productions with application of mercury catalysts in Karaganda and Pavlodar regions: a) acetaldehyde production of PO «Carbide» in Temirtau and b) chloride-alkali production of PO «Chimprom» in Pavlodar led to mercury pollution of Nura river and Northern industrial zone of Pavlodar city. Approximate volumes of mercury inflow into the environment (soil, Nura River, Lake Balkyldak) are estimated at 2300 and 1300 tons, respectively. Demercurization measures of the above mentioned historical mercury pollution (project «Nura River Cleaning», 2004-2013; project of demercurization of decommissioned production of chlorine and caustic soda by mercury method, 1994-2004) did not completely eliminate the problem, but only temporarily neutralized it. The volumes of mercury remaining after the closure of these chemical facilities were partially sold at JSC «Khaidarkan Mercury Plant» (with PA «Khimprom», Pavlodar), and mercury with PA «Karbid» (Pavlodar).Temirtau, in the amount of more than 3 tons of mercury, which was stored for a long time in the warehouse of «Temirtau Electrometallurgical Plant» LLP and was recognized by the court as «ownerless hazardous waste received into the republican ownership», according to the current legislation of the Republic of Kazakhstan, was sold by the state in 2014, «Merkur-Center KZ» LLP. Currently, the said mercury is stored in an environmentally safe manner in a protected warehouse until the relevant decision on it is taken by «Merkur-Center KZ» LLP (most likely, its export for industrial use). It should be noted that according to the current legislation of the Republic of Kazakhstan, this mercury is no longer considered a waste, but is sold as a commodity.

2.5.2 Manufacture of mercury-containing consumer goods

Mercury-added products are also not manufactured in the Republic of Kazakhstan. All mercury-containing products are imported, which, however, does not solve the problem of further fate of such products at the final stage of their life cycle – recycling.

2.6 Data on the use of mercury-containing consumer goods

It is known that a very wide range of consumer products (such as thermometers and fluorescent lamps), as well as products in which mercury must be added to ensure their functionality (such as dental amalgam and pressure gauges), are used nationally. These products may be domestically produced, but may also be imported and therefore require separate quantification.

Issues related to the accumulation and disposal of mercury-containing wastes occupy an important place among current environmental problems, which is due, on the one hand, to the widespread use of mercury in production processes, the use of mercury-containing products and devices in the home, health care, transportation, preschool, educational and scientific institutions, and on the other hand – the high toxicity of mercury and its compounds[8].

Mercury inputs to the environment from mercury-added products are significant in many countries and are therefore important for quantification. Typically, most of the revenues from

[8] Research report on the topic: «Analysis of mercury environmental pollution in the Russian Federation». Center for Scientific Research under Ministry of Economy of the Russian Federation and Ministry of Ecology of the Russian Federation. 1999 year. (in Russian)

products are generated during the recycling phase of the product's life cycle. Most of these products are used in large quantities by private consumers. Thus, they are distributed throughout the country and can be disrupted during use and can be disposed of in waste. Management solutions such as product marketing restrictions, separation of mercury-added product waste collection and/or provision of alternatives can be important to reduce such revenues. As a basis for decision, emissions from the recycling phase of mercury-added products are calculated separately in this methodology to indicate the relative importance of different product categories. To avoid double counting in the estimation of mercury inputs during waste treatment, inputs from products are subtracted from the total inputs.

2.6.1 Mercury thermometers

This subcategory includes medical mercury thermometers; other glass mercury thermometers (air, laboratory, dairy, etc.); mercury engine control thermometers and other large industrial/special purpose mercury thermometers.

Mercury thermometers have traditionally been used for most mid-range temperature measurements. Today they are increasingly being replaced by electronic and other types of thermometers, but the degree of substitution is likely to vary from country to country. Several European countries have already banned the use of thermometers and other mercury-containing products, such as Sweden, Denmark, the Netherlands and France.

The main remaining applications may include medical thermometers (for measuring body temperature in hospitals, at home, etc.), ambient temperature thermometers, thermometers in chemical laboratories, and thermometers in some installations (large diesel engines) and industrial equipment. Mercury thermometers can contain about 0.6 to several hundred grams/unit, depending on the application.

In this inventory, the number of thermometers was taken from the Customs website.

Table 7 presents all information on imports and exports of mercury-containing products and mercury in the mercury thermometers category in 2016.

Table 7 – Imports and exports by mercury thermometer category in 2016

№	Name	Export			Import		
		tons	items	mercury, kg	tons	items	mercury, kg
1	Liquid thermometers, direct reading: medical	0	0	0	15.4	851,247	510.7
2	Liquid thermometers, direct reading: Veterinary	0	0	0	0	172,2	0.1
3	Thermometers and pyrometers not combined with other devices: electronic	0.2	163	0.1	40.3	494,404	296.6
4	Barometers not combined with other measuring instruments	0	3	0	1.1	6,689	4
5	Other electronic devices	0	5	0	2.6	17,205	10.3
6	Other devices	0	26	0	7.2	46,086	27.7
7	Pressure measuring or control instruments and equipment, not electronic, spiral or metal diaphragm pressure gauges	0.3	256	0.2	42.5	74,829	44.9
8	Instruments and equipment for pressure measurement or control	0.8	1170	0.7	73.5	162,605	97.6
9	Spectrometers, spectrophotometers and spectrographs based on the action of optical radiation (ultraviolet, visible, infrared)	0.1	1	0	15.7	217	0.1

10	Instruments and equipment based on the action of optical radiation (ultraviolet, visible part of the spectrum, infrared), other	0	12	0	40.3	15,954	9.6
11	Manostats	0	12	0	40.3	15,954	9.6
12	Thermostats, not electronic, other	0.3	1851	1.1	54.1	345,889	207.5
12	Thermostats, not electronic, with an electrical trigger	0	3	0	7.2	214,978	129
14	Thermostats, electronic	0.1	1	0	621.1	2,432,445,0	129
15	Other devices and devices for automatic regulation or control for civil aviation for aircraft engines production	1.3	156	0.1	325.2	244,470	146.7
16	Other devices and devices for automatic regulation or control	0	0	0	-	-	0

«Mercury thermometers» subcategory economic activity indicator – number of sold items per year. Taking into account the fact that no mercury-containing products are produced in Kazakhstan, the data on the number of thermometers was taken from the website of the customs authorities. Thus, for medical mercury thermometers the import of goods under the code FEACN 9025 11 20 01 «Liquid, direct reading: medical» is taken into account. Their import in 2016 amounted to 851,247 units. However, it should be noted that this FEACN code includes not only mercury thermometers, but also other, for example, alcoholic thermometers, etc. («breakdown» is not provided for).

In assessing this sub-source category, a so-called «conservative» approach based on the principle of «it is better to overestimate rather than underestimate emissions from sources» has been used.

Thus, the use of medical thermometers in the Republic of Kazakhstan was the source of **851** kg of mercury in 2016.

2.6.2 Electrical switches and relays

Mercury has been (and continues to be) used in various electrical switches and relays. In some countries, mercury in electrical components has been subject to replacement over the past two decades with mercury-free substitutes that are now used in some countries for most or all of these applications. However, the condition and extent of replacement is likely to vary considerably, depending on the countries. Moreover, regardless of the replacement status, mercury switches and relays are likely to be present in waste for many years due to the very long service life of these products. This subcategory is a very diverse group of products, both in terms of differences in application, mercury content and lifetime for electrical components, which may require considerable effort to estimate the mercury emissions subcategory.

The primary use of elemental mercury in the manufacture of electrical apparatus is in the interlocking relays, also referred to as «silent» switches. The mercury tilt switch is constructed by adding mercury to a glass tube containing metal wire contacts and then sealing the tube. External mechanical force or gravity activates the switch by moving the switch from vertical to horizontal position, causing the flow of mercury from one end of the tube to the other, thus providing a channel for the electric current.

Since mercury is contained in sealed glass flasks inside the device, it does not enter the environment during normal use. As soon as the switch breaks down, mercury enters a variety of media, including air (in the form of vapours), earth and waste water.

Calculation of the amount of mercury emitted from switches and relays is possible based on the total population. Thus, as of the end of 2016, the total population of the Republic of Kazakhstan was 17,918,214 people. The default input factor, according to the Methodology, is 0.14 grams of mercury per year per person living in the country. Access to electricity is 100%.

Thus, we obtain that the subcategory «Electrical switches and relays» has become a source of **2,509** kg of mercury per year.

2.6.3 Mercury-containing light sources

This subcategory includes fluorescent lamps (double-sided); compact fluorescent lamps (single-sided); and other mercury-containing light sources.

Mercury is used in small quantities per lamp in a number of different types of fluorescent tube discharge lamps and single-sided compact fluorescent lamps (CFLs) as the most common. Other mercury-containing light sources accounted for include: special lamps for photographic purposes, chemical analysis (atomic absorption spectrometry lamps), ultraviolet sterilization, and backlighting of flat-screen computers (and possibly TV sets).

Elemental mercury is introduced into the tube at the time of manufacture and acts as a multiphoton source producing ultraviolet light when an electric current passes through the tube. Initially, mercury in fluorescent lamps has two different chemical compositions: vapor-phase elementary mercury and divalent mercury adsorbed on fluorescent powders, metal lamp tips or other components. The amount of mercury required in the form of steam in the discharge to power the lamp is 50 µg – approximately 0.5 to 2.5% of the total amount of mercury placed in the lamp during manufacture. Over time, mercury in the tube reacts with powder phosphorus, which covers the inner surface of the tube, and it loses its effectiveness. Thus, the lamp should have a sufficient initial amount of elemental mercury so that at least 50 µg is available as steam even at the end of the lamp's nominal life (usually 5 years of use for line lamps in commercial use, and approximately the same amount for CFL lamps used in residential areas). At the end of the lamp life, most of the mercury is present in divalent form.

The type of mercury content of lamps is used as an input factor for all phases of the life cycle.

Table 8 – Mercury-containing light source category imports and exports in 2016

№	Name	Export			Import		
		tons	items	mercury, kg	tons	items	mercury, kg
1	Gaseous discharge fluorescent lamps with thermocathode double socket	0	4	0	21.3	196,707,00	4.8
2	Other discharge fluorescent lamps with thermocathode	6	32,326,00	0.79	233.3	4,005,216,00	98.1
3	Mercury lamps	0	0	0	11.5	67,814,00	1.7
4	UV or infrared lamps; arc lamps, other	0,1	26	0	73	235,306,00	5.8
5	Sodium lamps	0	0	0	2.9	19,965,00	0.5
6	Metal halide lamps	0	223	0.01	3.4	48,941,00	1.2

Thus, in the category «Mercury-containing light sources» imports of mercury in 2016 amounted to 112.1 kg, exports – 0.8 kg.

The indicator of economic activity of this subcategory is the number of sold items per year. In this case, the amount of imported goods was taken into account.

According to the Methodology of conducting Level 2 of the mercury inventory, it is necessary to separate mercury lamps by types. This was done in the course of the calculations. The following imported goods were included in the calculation: fluorescent lamps (double-sided) – 196707 pcs. (default input factor is 25 mg mercury/pcs), compact fluorescent lamps (single-sided compact fluorescent lamps (CFL)) – 4,005,216 pcs. (default input factor is 10 mg mercury/pcs.),

high-pressure gaseous mercury – 67,814 pcs. (default input factor is 30 mg mercury/pcs.), high-pressure sodium lamps – 19,965 pcs. (default input factor is 20 mg mercury/pcs.), UV lamp – 235,306 pcs. (default input factor is 15 mg mercury/pcs.) and metal halide lamps are 48941. (default input factor is 25 mg mercury/pcs.)

Thus, the total volume of mercury emissions from the category «mercury-containing light sources» in 2016 was **52** kg.

2.6.4 Mercury batteries

The use of mercury in different types of batteries was common and was one of the largest products in which mercury was used. Mercury was mainly, or even exclusively, used in primary (i.e. non-rechargeable) batteries. Mercury is used in high concentrations (about 30-32% by weight) in mercury oxide batteries (sometimes called mercury-zinc batteries), where mercury oxide serves as the positive electrode of the battery. They were probably mainly sold as tablet type batteries in the west, but also in large cylindrical and other forms. In a number of countries, sales of mercury oxide batteries are currently severely restricted and may still be exempted from prohibition for some specific uses (e.g. military use in some countries). In the following other types of batteries, mercury has served as a reaction modifier, preventing the development of gas (and hence damage) during battery use, as well as as a corrosion inhibitor. Previously, in the European market, the concentration of mercury in alkaline cylindrical batteries was about 1%. Due to environmental constraints in large Western markets, consumption of mercury with cylindrical alkaline batteries has decreased, however, and most global brands are now manufactured without intentional addition of mercury. However, at the national or regional level, there are still some brands of alkaline batteries with mercury added. Alkaline pellet type batteries with silver oxide and zinc/air type still contain mercury in most cases (about 1% by weight). To date, other types of batteries are not considered mercury-containing.

Table 9 – Mercury batteries import and export in 2016

№	Name	Export			Import		
		tons	items	mercury, kg	tons	items	mercury, kg
1	Other mercury oxide primary cells and primary batteries	0	0	0	0	3	0.0
2	Air-zinc primary cells and primary batteries	0	0	0	0.8	478,297	4.8
3	Manganese dioxide, alkaline primary cells and primary batteries, manganese dioxide, alkaline, etc.				85.2	4,003,974	40.0
4	Other silver oxide primary cells and primary batteries	0	0	0	1.1	378,975	3.8
5	Lithium button elements	0	0	0	15	1,876,172	18.8
6	Manganese dioxide alkaline cylindrical elements	0	0	0	361.1	11,686,874	350.6
7	Other marganese dioxide cylindrical elements	0	0	0	361.1	11,686,874	350.6

In 2016, alkaline dioxide-manganese cylindrical elements and other manganese dioxide cylindrical elements accounted for about 40% of the goods import market. «Manganese dioxide, alkaline primary cells and primary batteries, manganese dioxide, alkaline, etc.» accounted for 13.3%. For other types of mercury batteries the share of import was insignificant.

Thus, in the mercury batteries category, imports of mercury in 2016 amounted to 768.6 kg, exports – 0 kg.

There is no production of own batteries in the Republic of Kazakhstan. Therefore, the data of customs authorities on imports of products were used for calculation. The following battery categories were used in the calculation: tablet type air-zinc batteries – 0.8 t (default input factor – 12 kg of mercury/tonne), alkaline tablet type batteries – 85.2 t (default input factor – 5 kg of mercury/tonne), Batteries with a silver oxide cell of the tablet type – 1.1 t (default input factor – 4 kg of mercury/tone), alkaline, except for the form of batteries of the tablet type – 361.1 t (default input factor – 0.25 kg of mercury/tone).

Thus, the total amount of mercury emissions from the mercury batteries category in 2016 was **530** kg.

2.6.5 Paints with mercury-containing stabilizers

Phenyl mercury acetate and similar mercury compounds were previously widely added as a biocide to water-based paints and can still be used in some countries. Such formulations have been used to extend the shelf life by controlling the fermentation of bacteria in cans (preservatives inside cans) and to slow down the formation of fungi on painted surfaces in humid conditions (fungicides).

In Kazakhstan, the production of paints and varnishes tends to decrease. According to the data, organizations engaged in paint production do not use mercury in production.

2.6.6 Cosmetics with whitening effect

Mercury has been used in skin cleansing creams, soaps, and as preservatives in some eye care products. Such products are rare or absent in some countries. Production and use has declined significantly in the West over the past decades. However, in some countries, production and use is still ongoing. Emissions can occur during the production, use and disposal of these products. Soap and cream are intended to be applied to the skin, and then they dry out and can stay on the skin all night. Soaps contain up to 3% mercury iodide (HgI2) and creams can contain up to 10% ammonia of mercury.

There is currently no information on the use of mercury-containing bleaching creams in Kazakhstan. Therefore, this category of mercury sources was not taken into account in the inventory.

2.7 Data on other products/processes using mercury

This category of mercury sources includes the following subcategories: dental amalgam («silver fillings»), pressure gauges, laboratory equipment and reagents containing mercury.

2.7.1 Amalgam for dental fillings

Tooth amalgam consists of an alloy of mercury, silver, copper and tin (usually about 44-51% mercury by weight). The alloy is usually supplied to dental clinics in the form of an alloy: 1) Pure mercury, together with a powder mixture of other metals, which are weighed and mixed in a mixer in the clinic itself, or 2) small capsules, where mercury and metal powder are kept in an appropriate proportion and need only be mixed (in a capsule before opening) in the clinic, before filling the cavity in the tooth. There may be other options based on the same principles.

Dental amalgam is a major source of increased exposure to inorganic mercury in the general population and in individual occupational groups (doctors, miners, caustic soda industry workers)[9]. Elementary mercury is a part of about 50% of dental fillings from amalgam. Mercury vapour is released from amalgam to mercury, which affects the level of mercury in the urine[10].

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[9] Martin, M.D., Naleway, C., Chou, H.N. Factors contributing to mercury exposure in dentists // J. Am. Dent. Assoc. – 1995. – Vol.126. – P.1502-1511

[10] Dye, B.A., Schober, S.E., Dillon, C.F., Jones, R.L., Fryar, C., McDowell, M., et al. Urinary mercury concentrations associated with dental restorations in adult women aged 16-40 years: United States, 1999-2000 //Occup. Environ. Med. – 2005. – Vol.62. – P.368-375

Mercury is released into the air, water and waste during amalgam production, use and disposal (e.g. after removing amalgam or teeth containing amalgam, during dental procedures or with lost teeth). Emissions may also occur at the end of a person's life with amalgam. For example, dental amalgam is a major factor in determining mercury emissions from crematoriums.
Currently, amalgam seals are not used in the Republic of Kazakhstan and have therefore not been included in the overall accounting for mercury inputs.

2.7.2 Manometers

Mercury is used in industrial and meteorological pressure gauges and pressure valves. For pressure valves used in heating systems and for educational purposes, the metallic mercury used is often supplied separately and is not included in the product. Mercury can be added during use in all of these types of products. Mercury can be disposed of with the device or separately. There are alternatives that do not contain mercury for all types of uses, which in some countries are gradually replacing mercury-containing analogues. It should be noted that quantification of the mercury supplied separately for these uses may be difficult to quantify, as it is difficult to distinguish these cases from other metal mercury consumption.

As with other products containing mercury, emissions may occur: 1) During the production of mercury-containing sensors/manometers (to air, water and soil), depending on the degree of closure of the production systems and the mercury handling rules of the individual production facilities; 2) due to breaking and loss of mercury from sensors/manometers (to air, water/wastewater, soil) during use, and 3) during disposal of mercury with pressure gauges/ sensors or separately after use (directly to soil or to landfills and subsequently to water and air), depending on the type and effectiveness of waste treatment procedures.

Calculation of mercury inputs from the use of different types of pressure gauges is possible based on an analysis of the total population of the country. At the end of 2016, the total population of Kazakhstan was 17,918,214. According to the Methodology, the entry rate for pressure gauges is 0.005 grams of mercury per person per year.

Thus, the mercury inflows from this sub-source category were **90** kg of mercury.

2.7.3 Laboratory equipment and reagents containing mercury

Mercury is used in laboratories in instruments, reagents, preservatives and catalysts. Some of this mercury is released into the air, mainly through ventilation outlets. However, most of the mercury can be discharged into the wastewater or disposed of as hazardous or household waste. Mercury may contain the following types of laboratory equipment: acid-base blood balance analyser, mercury electrodes, blood lead analyser, mercury droplet electrode, Coulter meter, centrifuges, electron microscope, thermostats, etc.

Mercury may also be contained in the following laboratory reagents: mercury sulphate, mercury chloride, mercury oxide, metallic mercury, Nessler reagent, mercury iodide, mercury fluoride, mercury bromide, mercury nitrate, mercury thiocyanate, mercury fulminate, etc.

According to the Methodology for conducting Level 2 of the mercury inventory, mercury emissions to the environment due to the use of laboratory equipment and reagents containing mercury are calculated on the basis of the total amount of laboratory equipment used (microscopes, centrifuges, analysers, etc.). However, the methodology does not provide for input indicators. An alternative is an estimate based on the total number of people living in the country. This approach has been used to conduct an inventory of mercury in the Republic of Kazakhstan.

At the end of 2016, the total population of Kazakhstan was 17,918,214. According to the Methodology, the entry rate for reagents is 0.01 grams of mercury per person per year, and for laboratory equipment – 0.04 grams of mercury per person per year.

Thus, the mercury inputs for this subcategory of sources were 179 kg of mercury for reagents and 717 kg for equipment. The total was **896** kg.

2.8 Secondary metal production data

This category includes the following subcategories: (1) production of reusable mercury («secondary production»), (2) production of reusable ferrous metals (cast iron and steel) and (3) production of other reusable metals.

2.8.1 Manufacture of recycled mercury

According to the Methodology, there are two main types of secondary mercury production: recovery of liquid mercury from dismantled equipment and recovery of mercury from scrap using recovery technologies. Three sources covering most of the recovery of liquid mercury worldwide are as follows: (1) Dismantling of chloride-alkali plants, (2) recovery from mercury meters used in gas pipelines, and (3) recovery from manometers, thermometers and other equipment.

Recycled mercury may be imported for countries where there are facilities using mercury. Received and treated mercury from these sources returns to the global mercury trade cycle. In some countries, mercury recycling activities contribute significantly to the supply of mercury to the market, while others do not currently have domestic processing plants. Some of these countries, which do not have their own recycling programmes, may export some of their waste with high mercury concentrations to foreign recycling facilities. Another source of secondary mercury generation is the demercurisation of mercury-containing waste, which includes collection and recycling procedures included in mercury recycling technology.

At present, the services on collection, storage, transportation, neutralization/recycling of mercury-containing waste in the country are provided mainly by small and medium businesses. In three regions of the country – Almaty, Zhambyl and South-Kazakhstan regions there are no specialized enterprises for processing of mercury-containing waste, waste neutralization services in these regions are provided by regionally located enterprises, mainly from Almaty.

As a result of the analysis of data provided by the above organizations, the demercurization of mercury-containing waste in 2014 resulted in the formation of about 14 kg of secondary mercury. As at the end of 2014 – middle of 2015, a total of 422 tons of metallic mercury had accumulated in some facilities, including 24.4 kg of ownerless mercury in Kostanay region, which is temporarily stored in the specialized facility. This figure is not included in the calculation table, as the activity indicator is «produced mercury, kg/year», and this volume of mercury is formed over a fairly long period of operation of enterprises. Accumulation of mercury is associated with the problem of sales of secondary mercury, as there are no enterprises in the country that use mercury in technological processes.

Thus, this subcategory of mercury sources was not included in the general table of calculations.

2.8.2 Production of reusable ferrous metals (cast iron and steel)

Cast iron and scrap steel are produced using various high-temperature processes. Mercury may be present in recycled metals/materials as a result of the presence of impurities of natural mercury in the input materials, as well as mercury contamination caused by anthropogenic use of mercury (e.g. mercury switches in vehicles used to process cast iron/steel). The starting point for calculating the amount of mercury input from this category is the amount of recycled transport per year. Based on the Methodology, a default input factor of 1.1 grams of mercury per vehicle is assumed.

In the Republic of Kazakhstan, there is currently no reliable information on the number of processed vehicles. Therefore, this subcategory of mercury sources was not taken into account in calculations.

2.9 Waste Incineration data

This category covers the following main subcategories:

1. Incineration of domestic/common waste – mainly domestic waste (residential and institutional), which may contain large quantities of mercury, both intentionally used in all types of materials and in different types of impurities.

2. Hazardous waste incineration is usually combustible waste collected separately that may contain hazardous substances, in particular mercury of intentional use (e.g. pesticides, paints, pharmaceuticals, mercury inorganic compounds), as well as general impurities.

3. Medical waste incineration is usually waste that poses a hygiene risk from hospitals, etc. that may contain mercury of deliberate use in the medical sector (thermometers, batteries, pharmaceuticals, dental materials, etc.) and in the form of general impurities. Medical waste is sometimes incinerated in separate facilities, sometimes in separate municipal waste incinerators specially equipped for this purpose.

4. Sewage sludge incineration – most of the mercury in the wastewater (from all intentional use of mercury, but often mainly from dental amalgam waste) is in the sewage sludge. If it is not applied to agricultural land as fertilizer, sewage sludge may sometimes be incinerated in separate plants, sometimes in municipal waste incineration plants.

5. Illegal waste incineration – private or local unofficial incineration of waste on open fire, in domestic heating furnaces, etc.

2.9.1 Incineration of household waste

The sources of mercury in the general waste stream are three main groups of inputs: (1) intentional use of mercury in waste products and process wastes, (2) impurities of natural mercury in high volume materials (plastics, paper, etc.) and minerals, and (3) mercury as human-generated residual contaminants in high volume materials. Concentrations of mercury directly depend on the ingress of mercury into the waste and are therefore very different in different countries and circumstances.

The Republic of Kazakhstan currently has no solid waste incineration plants, i.e. this method is not used for solid waste disposal. Thus, this subgroup of mercury sources was not considered in this inventory.

2.9.2 Incineration of hazardous waste

Mercury enters the hazardous waste stream, mainly from the intentional use of mercury in waste products and process wastes. Mercury concentrations are directly related to mercury inputs to waste.

Hazardous waste is sediment and waste that contains significant quantities of hazardous materials. In general, all materials, including consumer goods, that require special precautions and restrictions during their handling and use, belong to this group. Any consumer goods that are labelled and are in the waste stream should be considered hazardous waste. They include solvents and other volatile hydrocarbons, paints and dyes, chemicals including pesticides and herbicides, pharmaceutical products, batteries, fuels, oils and other lubricants, and products containing heavy metals. In addition, all materials contaminated with these materials, such as impregnated fabrics or paper, treated wood, product residue, etc., are considered hazardous wastes.

The mercury content of the waste determines the ingress of mercury. Combustion technology and particularly the flue gas treatment systems used determine the distribution of mercury emissions between air emissions, combustion and flue gas treatment in solid waste and water discharges. Mercury inputs to hazardous wastes may vary significantly from country to country due to differences in waste segregation and treatment/cleaning regulations. In general, all mercury will be released to the atmosphere during the incineration of hazardous waste.

In the Republic of Kazakhstan, legal entities are obliged to handle hazardous waste in accordance with the requirements of the Environmental Code of the Republic of Kazakhstan and deliver it to specialized enterprises or independently dispose of it, certain types of hazardous waste are subject to incineration.

The indicator of economic activity is the volume of burnt waste. According to the data received from the enterprises, the volume of incinerated hazardous waste in 2016 amounted to 73,626 tons. Mercury input factor – concentration of mercury in hazardous waste, default is 24 g/t.

Thus, in 2016, **1,767** kg of mercury entered the environment as a result of incineration of hazardous waste in the Republic of Kazakhstan.

2.9.3 Incineration and open burning of medical waste

Medical waste includes infectious and non-infectious waste produced by various health, veterinary or research enterprises and organizations, such as hospitals, dental clinics, nursing homes, veterinary clinics, medical laboratories, medical and veterinary schools, research organizations. To ensure the safe disposal of viruses, bacteria and pathogens, these wastes are often thermally treated by incineration. A medical waste incinerator can be any device suitable for the incineration of medical waste. In some countries, medical waste is incinerated in facilities for the incineration of hazardous or household waste suitable for this purpose.

According to national legislation, in Kazakhstan only infectious waste of classes B and C is incinerated.

The economic activity indicator is the volume of medical waste incinerated. According to data received from enterprises, the volume of medical waste incinerated in 2016 was 24,306 tons. Mercury input factor – concentration of mercury in medical waste, default is 24 g/t.

Thus, in 2016, **583** kg of mercury entered the environment in the Republic of Kazakhstan as a result of medical waste incineration.

2.9.4 Incineration of sewage sludge

Collector sludge (we are more accustomed to sludge) is the product of all wastewater treatment processes regardless of its origin (e.g. wastewater from domestic, agricultural or industrial activities). Mercury concentrations are directly dependent on mercury inputs to wastewater and therefore vary greatly between countries and circumstances. If concentrations of hazardous substances are low enough, in some countries lagoon can be used as fertilizer for agricultural land. Otherwise, sludge may be incinerated (alone or in combination with other wastes in power plants, solid waste incinerators, cement kilns, etc.), disposed of in landfills or undergo other treatment such as wet oxidation, pyrolysis, conversion to gas, etc.

The combustion process of the collector sludge includes two main steps. The first stage is the dewatering of the sludge (or evaporation of moisture from the sludge). The sludge is usually dewatered until it contains 20-35% solids. Systems using thermal conditioning processes regularly produce dewatered sludge that contains 40% surplus solids. The sludge is usually burned without additional fuel if it contains more than 25% of the solids. After dewatering, the sludge is sent to a combustion plant where thermal oxidation takes place. The following description refers to the combustion of sludge in individual plants, often an integral part of large wastewater treatment plants: unburned residual ash is removed from the plant (usually on a continuous basis) and disposed of in landfills or reused (bricks, concrete, asphalt, etc.). Some of the non-combustible waste, as well as unburned volatile organic compounds, are removed from the plant with the waste gas stream. Traps are used to remove contaminants from the waste gas stream, mainly scrubbers for wet cleaning. The gas stream then flows out and the contaminants collected by the scrubber are directed back to the head of the wastewater treatment plant along with the scrubber drain (and thus re-fed to the wastewater treatment system). Because mercury and mercury compounds are relatively volatile, most of the mercury leaves the combustion chamber in the waste gas; concentrations in the ash sludge are often negligible.

The indicator of economic activity is the volume of collector sludge burnt. Mercury inlet factor – concentration of mercury in the incinerated collector sludge. By default, 2 g/metric tonne of sewage sludge is assumed.

In the Republic of Kazakhstan, 14.94 tonnes of sewage sludge was used for incineration in 2016. Mercury emissions, in this case, are so small that the calculation table does not reflect their value.

2.9.5 Illegal incineration of waste

Illegal incineration is defined as the incineration of waste undertaken under illegal conditions, in drums, containers or on the ground, without flue gas capture and with a diffuse distribution of incineration residues over the ground. If mercury is present in the waste, some of the mercury is emitted into the air, while others remain in the incineration sludge (including unburned and semi-decomposed waste) with the possibility of additional subsequent releases of mercury into the air, groundwater and groundwater. Given the volatility of mercury, it is assumed that the majority of mercury is emitted into the air as a result of illegal incineration. This method of waste disposal may pose a risk to the local community where it occurs, as emissions into the air (several potential contaminants) are not captured and sediments may cause groundwater contamination.

According to the Environmental Code of the Republic of Kazakhstan, incineration of waste at landfills is prohibited. At the same time, spontaneous ignition of waste sometimes occurs, but it is not possible to estimate its volume. In addition, there is no data on illegal incineration of waste. Therefore, it is impossible to objectively estimate the volume of illegally burnt waste. Thus, this subcategory of mercury sources was not taken into account in the inventory of mercury.

Thus, in 2016, as a result of incineration of various types of waste (hazardous and medical waste), **2,350** kg of mercury were delivered to the environment.

2.10 Data on waste disposal, disposal to landfill and wastewater treatment

This category of mercury sources includes the following subcategories: 1) controlled landfills/ sediments, 2) unauthorized landfills, 3) waste water collection and disposal/ treatment system.

2.10.1 Controlled waste/sludge landfills

Mercury in the general waste stream comes from three main groups: 1) Intentionally using mercury in used products and process wastes; 2) impurities of natural mercury in high volume materials (plastics, tin cans, etc.) and minerals; and 3) mercury as anthropogenic residual pollution in high volume materials. The quantitative distinction between disposal, incineration and other types of waste treatment varies from country to country. The types of waste, and therefore the mercury content, allowed in disposal/storage facilities may vary from country to country, and storage facilities containing the most hazardous waste fractions, e.g. chemicals or solid residues from incineration, sometimes provide better protection for groundwater and other types of environment.

Relatively small amounts of mercury (seepage water and surface washout) are washed out of the water storage facility each year over the life of any storage/disposal facility, and with air into the atmosphere, as part of the mercury slowly evaporates from the waste. The fate of mercury discharged with water is highly dependent on the availability and effectiveness of the protective layer under the storage facility and wastewater treatment. If the water is not collected and sent for wastewater treatment, mercury (and other substances) may contaminate the soil and groundwater under and around the storage facility. If water is sent for treatment, mercury is mainly transferred to the sludge fraction and used in land use or otherwise, while the rest is discharged from the wastewater treatment plant. The most significant source of mercury inputs to the environment associated with waste disposal is, of course, the actual accumulation of waste, and therefore mercury, at the facility, possibly causing long-term environmental impacts through excavation, urbanization and other impacts. Mercury input factor – the concentration of mercury in the waste.

To date, there is no separate collection and sorting of MSW at the system level in the country, there is no capacity for their sorting and integrated processing. Almost the entire volume

of MSW generated is located at landfills. In 2016, 2,813,600 tonnes of waste were collected and transported to landfills. The economic activity indicator is the volume of waste disposed of. The default input factor is assumed to be 5 g/t.

Thus, in 2016, waste disposal at landfills and landfills was a source of **14,068** kg of mercury.

2.10.2 Unauthorized landfills

Illegal waste dump is defined as a waste dump created in illegal conditions without public control and without taking safety measures to reduce the inflow of pollution into the environment. If mercury is present in the waste, mercury may enter the soil, air, groundwater and groundwater. This method of waste management can pose a significant risk to the local community in which it occurs, as mercury (and other contaminants) may cause contamination of local groundwater.

In the Republic of Kazakhstan, in unidentified locations around rural and urban settlements, unauthorized landfills occur periodically and are disposed of annually by local executive authorities at the expense of the local budget. However, given that such waste is still being disposed of at landfills, we believe that this type of waste has been accounted for in the Controlled Waste/Sediment Dumps section.

2.10.3 Wastewater collection and disposal/ treatment system

The most important determinants of mercury inputs from wastewater are the amount of mercury-containing waste discharged into the wastewater system and the concentration of mercury in that waste. The content of mercury in wastewater is mainly derived from two groups of sources: (1) intentionally used mercury in products and processes (e.g., dental amalgam, mercury spilled from thermometers and other devices, and industrial discharges), and (2) atmospheric mercury washed away by precipitation in wastewater systems (from both anthropogenic and natural sources). As such, wastewater treatment is an intermediate source of mercury emissions, where the inlet of mercury from initial mercury contamination is distributed through water (with treated water), soil (using of sludge as fertilizer) and air (through incineration and sludge). In addition, some of the sludge is sent for disposal.

Some large industrial enterprises have separate waste water treatment plants. Direct discharges of untreated wastewater in some countries may occur from both industrial and domestic wastewater systems. Pumping wastewater systems that receive wastewater and rainwater from roads and other water bodies are more susceptible to periodic direct discharges due to heavy rainfall (due to wastewater bypassing the treatment systems due to high volumes).

Mercury inlet factor – average concentrations of mercury in incoming wastewater. Default is 5.25 mg/m3. The economic activity indicator is the amount of wastewater treated or transported. The volume of treated wastewater in 2014 was 838,001,377 m3. The amount of mercury in the discharges, excluding double counting, was **4,400** kg.

Thus, the category «Waste Disposal, Waste Disposal and Wastewater Treatment» became a source of **18,468** kg of mercury in 2016.

2.11 Crematorium and cemetery data

According to the Methodology, the introduction of mercury into the environment is possible as a result of cremation and burial of human bodies. Mercury emissions from these processes are associated with the presence of mercury amalgam dental fillings in the human body, and small amounts of mercury in body tissues, such as blood and hair, can be released into the atmosphere during cremation.

2.11.1 Crematoriums

The Republic of Kazakhstan is a democratic, secular and law-governed state, but historically the bodies of the dead have been buried rather than cremated. In this connection, there are no crematoriums in Kazakhstan, and there are no plans to build them in the near future. In

isolated cases, those wishing to cremate the corpses of relatives send them to the nearest crematoriums located in the Russian Federation. Relevant organizational services are provided by some private ritual agencies of the country.

Based on the foregoing, we hereby accept that all the dead in the Republic of Kazakhstan are buried in cemeteries.

2.11.2 Cemeteries

According to statistics, in 2016 the number of deaths in the Republic of Kazakhstan was 130,532. In calculating the inflow of mercury into the environment, a default input factor of 2.5 g of mercury per buried body is assumed. All released mercury enters the soil.

The total volume of mercury inflow into the environment due to burial amounted to **326** kg.

2.12 Stocks of mercury and/or mercury compounds and storage conditions

2.12.1 Stocks of mercury and/or mercury compounds

On the territory of the Republic of Kazakhstan there are «historical» mercury pollution in Karaganda and Pavlodar regions, approximate volumes of mercury inflow into the environment (soil, Nura River, lake-collector of waste water Bylkyldak), which amounted to 2300 and 1300 tons, respectively.

1. Acetaldehyde production of PO Karbid in Temirtau city and mercury pollution of Nura river

Development of acetaldehyde production by Kucherov's method by direct hydration of acetylene in the presence of a catalyst – mercury (II) sulphuric acid salt – was started at the Karaganda plant of SK Temirtau (since 1982 – PO «Carbide», since the beginning of the 90s – JSC «Carbide») in August 1950. The project was developed by Giprokauchuk in Moscow. The technological scheme of the operating acetaldehyde production of the company IG «Farbenindustri» in Auschwitz was used, as well as the equipment removed from Germany by reparations after the Second World War. Thus, the technological scheme of acetaldehyde production implied losses of mercury in the form of atomic-dispersed mercury and mercury organic compounds in commercial products, metal compact, atomic-dispersed, ionic inorganic mercury and mercury organic compounds in sewage and gaseous mercury in vent effluents. In addition, wastewater from mercury workshops contained large amounts of insoluble mercury compounds and elementary mercury in suspended and colloidal form. These substances were also not completely deposited during sulphide treatment. Thus, sulphide treatment without peroxidation of Hg (I) and Hg (0) purified the effluent only from compact metallic mercury and a part of inorganic ionic mercury, bringing the other part into atomic-dispersed state and thus increasing its content in the effluent.

2. Chloride-alkali production of PO Khimprom in Pavlodar

Shop No. 3 of Pavlodar Chemical Plant (PCP, then it was renamed into «Khimprom» PA in Pavlodar, JSC «Khimprom») produced chlorine and caustic soda by means of electrolysis with mercury cathode from 1975 to 1993. In the electrolysis hall of the building 31, 80 SDM 150-7.3 electrolysers were installed in four rows. Regulated loading of metallic mercury per one electrolyser was 2750 kg, i.e. only 220 tons of mercury were in electrolysers.

The temperature of solutions in the electrolyser reached 80-85oC, in the decomposer – 80-100oC. At high temperature all products and wastes of electrolysis were polluted with mercury: anolyte with depleted content of sodium chloride, chlorine, alkali solution and hydrogen. Alkali was contaminated with elementary atomic-dispersed mercury, anolyte, chlorine and abgases contained soluble mercury (II) chloride in water – sulphur, hydrogen and vent – gaseous mercury. During the operation of the electrolysers, a large amount of mercury was sludged, forming amalgam oil, which was manually removed from the electrolysers through the pockets. The pockets of the amalgam washers were also supplied with purified water.

All these effluents were initially discharged into the Balkyldak industrial waste water evaporator, and later into special ponds – special experimental-industrial evaporation ponds – were built in 1976 and designed to receive 200 m3/day or 73000 m3/year of mercury-containing effluents. They were located 1.5 km to the north of the 1st industrial site of PHZ on the southern bank of the Balkildak reservoir. The special ponds consisted of 3 sections with the size of 344x200 m, with the height of dams – 3 m, estimated depth of water in the sections – 2 m, capacity 115000 m3 each and total area of water mirror 18.3 ha. The bottom of the evaporators was a rolled soil lined with a special two-layer screen. The screen consisted of two layers of stabilized polyethylene film 0.2 mm thick and three protective sand layers with a total capacity of 1 m. Two sections of the special ponds were to be used as workers, one as an emergency pond.

The Balkildak reservoir is located 5.5 km to the east of the Irtysh River floodplain and had a design capacity of 56.92 million m3, a water mirror area of 15.9 km2 and an evaporation capacity of 9.6 million m3 at a critical level of 109.5 m (according to the original design of 1975) and an estimated capacity of 74.0 million m3, a water mirror area of 18.0 km2 and an evaporation capacity of 11.4 million m3 at a critical level of 110.8 m.

As of mid-2015, a total of 422 tonnes of metallic mercury had accumulated in some enterprises, including 24.4 kg of ownerless mercury in Kostanay region, which is temporarily stored in the specialized enterprise.

Accumulation of mercury is associated with the problem of sales of secondary mercury, as there are no enterprises in the country that use mercury in technological processes.

Due to the high cost of services for decontamination of substandard (second-hand) metallic (waste) mercury (about 300 tenge per gram of mercury), many enterprises, mainly laboratories, temporarily store mercury on the territory of the enterprise without transferring it to waste, so they are unlikely to be included in waste reports.

Based on the National Report on the State of the Environment and Use of Natural Resources of the Republic of Kazakhstan, 186 tons of mercury-containing lamps in the form of waste were formed in 2016.

2.12.2 Assessment of current storage conditions

Assessing the conditions of storage of ownerless mercury and other hazardous chemicals stored on the territory of «TEMK» JSC in Temirtau, these were recognized as ownerless according to the decision of the court of Temirtau city and were transferred to the Republican ownership. «Zhasyl Damu» JSC carried out procedures for the inspection of chemicals and determined their estimated cost of «0» tenge.

In 2016, a tender was held for the sale of these wastes, and based on the results of this tender, the wastes were recognized as unclaimed and are subject to safe disposal and disposal at the expense of the national budget. In 2016, the Ministry of Energy of the Republic of Kazakhstan submitted a budget application for allocation of funds in 2017 to carry out procedures for safe disposal and disposal of these wastes, but the application was not supported by the Republican Budget Commission.

In 2017, the RSE «Committee for Environmental Regulation and Control» of the Ministry of Energy of the Republic of Kazakhstan sent a letter to the Karaganda region Akimat on the need to consider the possibility of conducting an inspection of liquid waste containers for leaks. The problem remains unresolved for 2017.

In 2016, in order to prevent secondary mercury contamination of the Nura River bottom sedimentation, TEMK signed a contract to adjust the project «Reconstruction of the industrial wastewater neutralization and treatment unit» to exclude new construction works that were allocated to a separate project «Construction of the industrial wastewater neutralization and treatment unit».

In August 2017, a positive conclusion was received from the state expert review of the project «Reconstruction of the industrial waste water neutralization and treatment unit of the chemical and metallurgical plant «TEMK» JSC in Temirtau with a capacity of 10,000 m3/day.

Purchase, delivery of equipment and construction and installation works will be carried out at the expense of «TEMK» JSC. The estimated cost is 242,428 million tenge.

In addition, in 2017, a positive conclusion was received from the state expert review of the project «Construction of a unit for neutralization and treatment of industrial wastewater in the western industrial zone of Temirtau, Karaganda region» with a capacity of 10,000 m3 /day, the customer is the State Institution «Natural Resources Management and Environmental Management of Karaganda». The estimated cost is 1,115,465 million tenge.

Regarding Lake Bylkyldak: according to the concept approved in 2016 for the rehabilitation of demercurriciation facilities and the waste water reservoir Bylkyldak, mercury monitoring by the contractor GIO TRADE LLP is carried out within the framework of environmental protection measures. The monitoring is carried out for atmospheric air, surface water, soil, groundwater (wells).

The main purpose of the monitoring is to determine the level of mercury content in the environment (air, soil, groundwater, surface water), as well as to control the current situation and identify possible risks for the population and the environment.

Based on the results of the monitoring, 6 hotbeds of mercury pollution are identified:

- landfill of mercury-containing wastes and soils;
- the area where the mercury electrolysis shop was located;
- former pumping station No.6;
- former mercury-containing water storage ponds;
- industrial waste water reservoir lake «Balkyldak»;
- mercury halo of groundwater.

Analysis of the results of the long-term mercury monitoring showed that the sanitary and epidemiological situation in the area of the former PA «Khimprom», despite the presence of six large mercury-contaminated foci, does not pose a threat to the population outside the SPZ and is characterized as stable-resistant in terms of mercury impact on the environment.

Small fluctuations are recorded which are due to seasonal fluctuations in the environment.

In 2017, the Department of Subsoil, Environment and Water Resources of the Pavlodar region adjusted the mercury monitoring program, which includes technological measures to develop new observation wells for monitoring mercury in groundwater, aimed at preventing contamination, pollution and depletion of water resources. The necessity of well construction is connected with annual monitoring of mercury water pollution. In 2017, mercury monitoring was carried out by the accredited laboratory of GioTrade LLP (Karaganda). A total of 334 samples were taken (75 air samples, 24 soil samples, 219 groundwater samples, 16 surface water samples).

In addition, within the framework of the grant, the Innovative Eurasian University is implementing a project to clean up Lake Bylkyldak from mercury using special nanomaterials.

2.12.3 Assessment of potential needs that may arise after ratification of the Convention

Kazakhstan's accession to the Minamata Convention on Mercury is likely to require the following actions

1. Continued implementation of the Mercury Monitoring Program
2. Ensuring the development of a new version of the hydrogeological model and subsequent monitoring to control the direction of groundwater flow
3. Introduction of new methods of solving the problem, using the mechanisms of international instruments
4. Promote cooperation with existing and participate in the development of future international projects, based on the Strategic Approach to International Chemicals Management (SAICM).

2.13 Trade in mercury and mercury-containing compounds, including sources and mercury processing activities

There are no activities in the Republic of Kazakhstan aimed at production and trade of mercury and its compounds.

2.14 Effects of mercury on human health and the environment

To date, WHO has proven that exposure to mercury – even in small quantities – can cause serious health problems and pose a threat to foetal and child development in the early stages of life. Mercury can have toxic effects on the nervous, digestive and immune systems, as well as on the lungs, kidneys, skin and eyes.

Taking into account the volume of production in the industrial sector of Kazakhstan, as well as the problem of «historical» mercury pollution in the Pavlodar and Karaganda regions, it is reasonable to assume that mercury pollution poses certain risks to the population and the environment of the Republic of Kazakhstan.

More detailed information on the impact of mercury on the health of the population of the Republic of Kazakhstan is provided in Section 4.1 Preliminary review of potential population groups at risk and potential health risks.

Chapter III: Policy, regulatory and institutional framework assessment

Mercury management issues need to be addressed as part of the overall government management of hazardous chemicals.

Since independence, Kazakhstan has repeatedly reaffirmed its commitment to environmental security and sustainable development by signing the outcome documents of the United Nations Conference on Environment and Development, being an active participant in the «Environment for Europe» process, as well as a Party to the most important international conventions on chemicals and hazardous waste management:

1. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
2. Strategic Approach to International Chemicals Management
3. Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
4. Protocol on Pollutant Release and Transfer Registers to the Aarhus Convention on Access to Information, Decision-making and Access to Justice in Environmental Matters
5. Protocol on Heavy Metals to the 1979 Convention on Long-range Transboundary Air Pollution
6. Globally harmonized system of classification and labelling of chemicals.

To date, the provisions of international conventions have been partially integrated into the current legislation of the Republic of Kazakhstan: issues of chemicals management along with the waste management sector have been included in one of the priority areas of the Concept for the transition of the Republic of Kazakhstan to a «green economy».

3.1 Analysis of the state policy and regulatory legal acts

Article 3: Mercury supply sources and trade	
Article description	
List of activities under relevant article	• Primary mercury mining for a period of up to 15 years (if it was carried out on its territory). • Identification of individual stocks of mercury or mercury compounds in the amount exceeding 50 metric tons, as well as sources of mercury supplies, ensuring the creation of stocks of mercury in the amount exceeding 10 metric tons per year. • Prohibition of mercury exports. • Prohibition of the import of mercury from a State that is not a party to the Convention.
Policies and regulations in place to enable the country to comply with the above provisions:	
Relevant regulatory legal acts	• Order of the Acting Minister for Investment and Development of the Republic of Kazakhstan dated 17.04.2015 No. 460 «On Approval of the Rules for Transportation of Dangerous Goods by Road and the List of Dangerous Goods Allowed for Transportation by Motor Vehicles on the Territory of the Republic of Kazakhstan» (in this order, mercury is specified in the special list of dangerous goods allowed for transportation by motor vehicles on the territory of the Republic of Kazakhstan).
Specific regulatory or policy aspects to be addressed / developed to ensure compliance with the provisions of the Convention	
• There is no mercury mining in the Republic of Kazakhstan and therefore the list of measures under this article will only cover exports and imports of mercury. There is also	

no production that uses mercury in production processes in Kazakhstan, and therefore the necessary regulations for the development of regulations should affect the export and transit of mercury through the country.

Article 4: Mercury-added products	
Article description	
List of activities under relevant article	• Prohibition of production, import or export of mercury-added products. • Taking action on mercury-added products. • Countering the production and distribution of mercury-added products through the mercury trade system.
Policies and regulations in place to enable a country to comply with the above provisions:	
Relevant regulatory legal acts	• Decision of the Council of the Eurasian Economic Commission dated October 18, 2016 № 113 «On the technical regulation of the Eurasian Economic Union» On limiting the use of hazardous substances in electrical engineering and radioelectronics (this document specifies the permissible concentration of mercury in homogeneous (homogeneous) materials). • Decision of the Board of the Eurasian Economic Commission of November 14, 2017 No. 147 «On Amendments to Decision of the Customs Union Commission of September 20, 2010 No. 375 and Decision of the Board of the Eurasian Economic Commission of April 21, 2015 No. 30» (this document contains a list of goods prohibited to be placed under the customs procedure of processing outside the customs territory (metals, scrap, metal waste containing mercury). • Order of the Minister of Transport and Communications of the Republic of Kazakhstan dated February 18, 2011 No. 79 «On Approval of the List of Dangerous Goods Intended for Transportation by Civil Aircraft» (the document contains the list of dangerous goods intended for transportation by civil aircraft, including mercury and mercury-containing compounds). • Order of the Acting Minister for Investment and Development of the Republic of Kazakhstan dated April 17, 2015 № 460 «On approval of the Rules for the transportation of dangerous goods by road and the list of dangerous goods allowed to be transported by vehicles in the territory of the Republic of Kazakhstan» (the document contains a list of dangerous goods allowed to be transported by vehicles in the territory of the Republic of Kazakhstan, including mercury and mercury-containing compounds). • Order of the Minister of Health of the Republic of Kazakhstan dated August 16, 2017 No. 611 «On approval of Sanitary Rules «Sanitary and Epidemiological Requirements to the objects of education» (the document contains a ban on the use of mercury thermometers in foodstuffs, and also regulates the conditions of storage of mercury-containing lamps). • Order of the Minister of Health of the Republic of Kazakhstan dated August 17, 2017 No. 615 «On approval of Sanitary Rules

	«Sanitary and Epidemiological Requirements for Preschool Institutions and Children's Homes» (the document contains an indication of the ban on the use of mercury thermometers in foodstuffs, and regulates the conditions of storage of mercury-containing lamps). • Decision of the Council of the Eurasian Economic Commission of July 20, 2012 № 58 «On the adoption of technical regulations of the Customs Union «Safety Requirements for Food Additives, Flavors and Technological Auxiliaries» (this document regulates the norms of mercury content in food additives). • Resolution No. 1398 of the Government of the Republic of Kazakhstan dated 29 December 2007 «On approval of technical regulations «Requirements for the safety of paintwork materials and solvents» (this document contains instructions on the prohibition of use in the composition of paintwork materials and solvents of mercury). • Decision of the Commission of the Customs Union of 27 November 2009 № 132 «On a single non-tariff regulation of the customs union of the Republic of Belarus, the Republic of Kazakhstan and the Russian Federation» (the document contains a list of hazardous waste, the import of which into the territory of the customs union is prohibited, as well as a list of hazardous waste limited to movement across the customs border of the customs union). • Decision of the Customs Union Commission of 9 December 2011 № 878 «On the adoption of technical regulations of the Customs Union «On the safety of personal protective equipment» (the document contains information on the permissible amount of migration and maximum allowable concentration of mercury released from the components (materials) of personal protective equipment). • Decision of the Commission of the Customs Union of 18 June 2010 № 317 «On the use of veterinary and sanitary measures in the customs union» (the document contains the norms of the content of mercury in various feeds for animals of plant origin). • - Decision of the Customs Union Commission of 17 August 2010 No. 341 «On the application of sanitary measures in the Customs Union» (the document contains the norms of mercury content in porridges and dairy products). • Decision of the Customs Union Commission of 23 September 2011 № 798 «On the safety of toys» (the document contains the norms of mercury in toys for children). • Decision of the Customs Union Commission of 23 September 2011 № 799 «On the safety of perfumes and cosmetics» (the document contains the norms of mercury content in perfumes and cosmetics). • Decision of the Customs Union Commission of 23 September 2011 № 798 «On the safety of products intended for children and adolescents» (the document contains the norms of mercury content in textile materials and school supplies).

Specific regulatory or policy aspects that will need to be addressed/developed to ensure compliance with the Convention
• Development of measures to tighten control over imported and exported goods in terms of mercury content, as well as compliance with the appropriate labelling and conformity of goods with the characteristics specified on the package.

Article 5: Manufacturing processes in which mercury or mercury compounds are used	
Article description	
List of activities under relevant article	• Prohibition of the use of mercury or mercury compounds in industrial processes. • Adoption of measures to restrict the use of mercury or mercury compounds in processes. • Prohibition of the use of mercury or mercury compounds in facilities that did not exist before the date of entry into force of the Convention.
Policies and regulations in place to enable a country to comply with the above provisions:	
Relevant legal instruments	• There are no normative legal acts regulating the implementation of this article.
Specific regulations or policies that will need to be addressed/developed to ensure compliance with the Convention	
• There is no production in the Republic of Kazakhstan in which mercury or mercury compounds are used.	

Article 8: Emissions	
Article description	
List of activities under relevant article	• Adoption of measures to control emissions. • Preparation of a national plan setting out the measures to be taken to control emissions and the expected targets, objectives and results. • Reduction of emissions using best available techniques and best environmental practices (no later than 5 years after the date of entry into force of the Convention). • Setting quantitative targets to monitor emission reductions from relevant sources. • Establish emission limit values to control emission reductions from relevant sources. • Development of an emission inventory methodology.
Existing policies and regulations that will allow the country to comply with the above provisions:	
Relevant regulatory legal acts	• There are no regulatory legal acts regulating the implementation of this article. • At the same time, monitoring of mercury content in environmental objects in areas of historical pollution (Karaganda and Pavlodar regions) is conducted.

Specific regulatory or policy aspects that will need to be addressed/developed to ensure compliance with the Convention
• The Republic of Kazakhstan is currently working to ratify the Protocol on Pollutant Release and Transfer Registers to the Aarhus Convention. • Analysis of the current methodological base and laboratory capacity of state institutions shows that not all regions of Kazakhstan have laboratory capacity to determine mercury in water, air and soil. According to the «Kazhydromet» RSE, only eight accredited chemical-analytical laboratories are accredited to determine the mercury content. At the same time, according to the Committee on Environmental Regulation and Control, only four laboratories currently include a definition of mercury in their accreditation scope. Thus, one of the activities aimed at meeting the obligations under this article is to equip the relevant laboratories, train staff and undergo accreditation to conduct mercury testing. • To strengthen the activities in this area, it is necessary to develop a National Plan of Control over Emissions and Releases of Mercury and Mercury Compounds.

Article 9: Releases	
Article description	
List of activities under relevant article	• Identification of relevant point source categories on a regular basis (no later than 3 years after the date of entry into force of the Convention). • Preparation of the National Mercury Release Control Plan and expected targets, objectives and results. • Maintenance of an inventory of releases from relevant sources.
Existing policies and regulations that will enable the country to comply with the above provisions:	
Relevant regulatory legal acts	• Decree of the Government of the Republic of Kazakhstan No. 1219 of 19 November 2010 «On approval of technical regulations «Requirements for the safety of toxic and highly toxic substances» (this document contains maximum allowable concentrations of mercury in water, water bodies of economic, drinking and cultural water use, as well as sanitary norms of allowable concentrations of mercury in soil). • ST RK ISO 5666-2010 «Nature protection. Hydrosphere. Determination of mercury content» (this standard establishes methods for determination of mercury content in ground, surface and waste water).
Specific regulatory or policy aspects that will need to be addressed / developed to ensure compliance with the Convention	
• In the Republic of Kazakhstan, mercury is monitored at historical sites of mercury pollution (Karaganda and Pavlodar regions). Thus, there are separate opportunities for monitoring mercury in the environment in the country, however, there is no comprehensive system of monitoring and control of mercury. This situation requires the development of a regulatory legal act regulating the systematic comprehensive assessment of mercury emissions and releases to the environment. • One of the activities aimed at meeting the obligations under this article is to equip relevant laboratories, train staff and undergo accreditation to conduct mercury testing.	

• To strengthen the activities in this area, it is necessary to develop a National Plan of Control over Emissions and Releases of Mercury and Mercury Compounds.

Article 10: Environmentally sound interim storage of mercury, other than waste mercury	
Article description	
List of activities under relevant article	• Adopt measures for the environmentally sound storage of mercury and mercury compounds.
Policies and regulations in place to enable the country to comply with the above provisions:	
Relevant regulatory legal acts	• Order of the Chairman of the Emergency Situations Committee of the Ministry of Internal Affairs of the Republic of Kazakhstan No. 246 dated December 22, 2017 «On some issues related to emergency response teams of the Emergency Situations Committee of the Ministry of Internal Affairs of the Republic of Kazakhstan» (this document describes the list of measures to be taken in case of a mercury spill).
Specific regulatory or policy aspects that will need to be addressed/developed to ensure compliance with the Convention	
• Development of measures to ensure the temporary storage of mercury and non-waste mercury compounds in an environmentally sound manner. • Consolidation of the list of developed measures by regulatory legal acts.	

Article 11: Mercury wastes	
Article description	
List of activities under relevant article	• Development of methods of regeneration, recycling, recovery or reuse of mercury wastes. • Prohibition of movement of mercury wastes across international borders (except for environmentally sound disposal).
Existing policies and regulations that will allow the country to comply with the above provisions:	
Relevant regulatory legal acts	• Environmental Code of the Republic of Kazakhstan dated January 9, 2007, No. 212 (the Code contains an indication that mercury-containing waste, batteries, accumulators and other hazardous components should be collected separately and transferred for disposal, recycling to specialized enterprises (Article 293), as well as a ban on placement of mercury-containing waste at landfills (Articles 301-302). • Order of the Acting Minister of Environmental Protection of the Republic of Kazakhstan dated August 2, 2007, N 244-p «On approval of the list of wastes to be disposed at different classes of landfills» (this order contains the list of mercury-containing wastes to be disposed at the landfills of the 1st class (landfills for hazardous wastes disposal). • Law of the Republic of Kazakhstan No. 541-IV «On energy saving and energy efficiency» dated January 13, 2012 (this law contains an indication that local executive bodies organize the

	disposal of mercury-containing energy saving lamps used by the population). • Order No. 15-05/864 of the Minister of Agriculture of the Republic of Kazakhstan dated 29 September 2015 «On Approval of the Rules for Disposal of Pesticides (Poisonous Chemicals)» (this order approved the rules for disposal of mercury-containing pesticides). • Law of the Republic of Kazakhstan dated December 11, 1998 N 313 «On ratification of the Agreement on uniform transit conditions through the territory of the Customs Union» (this law contains a list of hazardous waste, transit of which is prohibited (including mercury-containing waste). • The Law of the Republic of Kazakhstan dated October 23, 2000 N 90-II «On ratification of the Protocol on amendments to the Agreement on uniform conditions of transit through the territory of the Customs Union member-states dated January 22, 1998» (this law contains a list of hazardous waste, transit of which is prohibited (including mercury-containing waste). • Order of the Minister of Environment Protection of the Republic of Kazakhstan dated May 31, 2007 N 169-p «On approval of the Waste Classifier» (this order approved the Nomenclature of waste (including mercury-containing waste). • Order No. 187 of the Minister of Health of the Republic of Kazakhstan dated 23 April 2018 «On approval of Sanitary and Epidemiological Requirements for Collection, Use, Application, Decontamination, Transportation, Storage and Disposal of Production and Consumption Wastes» (this order approved the requirements for transportation of mercury-containing wastes). • National Standard of the Republic of Kazakhstan ST RK 1513-2006 «Resource Saving. Waste management. Classification and processing methods of mercury-containing waste» (this standard establishes the classification of mercury-containing waste depending on the content of pure metallic mercury in them).
Specific regulatory or policy aspects that will need to be addressed/developed to ensure compliance with the Convention	
• Currently, the Republic of Kazakhstan lacks a clear system of monitoring and control over the turnover of mercury-containing waste. For example, waste disposal companies that contain mercury are forced to store waste mercury in special containers. Enterprises have no other option but to place waste mercury in sealed tanks and store it, as there are no plants for processing and receiving mercury in Kazakhstan. • It is necessary to include in the Environmental Code of the Republic of Kazakhstan a section devoted to mercury wastes, methods of their transportation, storage and disposal. • Perhaps it is necessary to toughen administrative responsibility for incorrect actions on mercury waste disposal, which could cause damage to the environment and the environment.	

Article 12: Contaminated sites	
Article description	

List of activities under relevant article	• Development of a strategy to identify and assess sites contaminated by mercury or mercury compounds.
Existing policies and regulations that will allow the country to comply with the above provisions:	
Relevant regulatory legal acts	• There are no regulatory legal acts regulating the implementation of this article. • Every five years, a programme for the development of the territory is approved at the regional level. The Pavlodar region Territorial Development Program for 2016-2020 specifies the need for annual mercury monitoring of the Northern Industrial Zone of the city of Pavlodar.
Specific regulatory or policy aspects that will need to be addressed/developed to ensure compliance with the Convention	
• The need to develop a list of measures that would allow monitoring of polluted participants on a systematic basis.	

Article 13: Financial resources and mechanism	
Article description	
List of activities under relevant article	• Ensuring that resources are made available to meet the obligations of the Convention.
Policies and regulations in place to enable the country to comply with the above provisions:	
Relevant normative legal acts	• Law of the Republic of Kazakhstan «On the Republican Budget». The budget of the Republic of Kazakhstan is approved by the relevant law. Thus, the Law of the Republic of Kazakhstan dated 30 November 2018 No. 197-VI «On the Republican Budget for 2019-2021» approved the budget for the next 3 years (this document contains budget items aimed at improving and preserving the quality of the environment). • Order No. 550 of the Minister of Energy of the Republic of Kazakhstan dated 21 December 2016 «On Approval of Budget Programs of the Ministry of Energy of the Republic of Kazakhstan for 2017-2019». Budget programs of state bodies include a set of measures to perform certain state functions, aimed at the implementation of certain tasks with the use of budget funds.
Separate regulatory or policy aspects that will need to be addressed / developed to ensure compliance with the provisions of the Convention	
• When forming budget programs of the Ministry of Energy of the Republic of Kazakhstan to provide for the need to fulfil the obligations of the Convention upon its ratification.	

Article 14: Capacity-building, technical assistance and technology transfer	
Article description	

List of activities under the relevant article	• Development, transfer and dissemination of modern environmentally sound alternative technologies.
Existing policy and regulatory measures that will enable the country to comply with the above provisions:	
Relevant regulatory legal acts	• Order No. 155 of the Minister of Energy of the Republic of Kazakhstan dated 28 November 2014 «On Approval of the List of the Best Available Technologies» (this document contains the list of the best available technologies in various industries).
Specific regulatory or policy aspects to be addressed / developed to ensure compliance with the Convention	
• Identify organizations responsible for technology transfer. • Capacity building of employees of these organizations. • Revision of Order No. 155 of the Minister of Energy of the Republic of Kazakhstan dated 28 November 2014 «On Approval of the List of Best Available Technologies».	

Article 16: Health aspects	
Article description	
List of activities under relevant article	• Promoting the development and implementation of strategies and programmes to identify and protect the public from exposure to mercury and mercury compounds. • Provision of appropriate health services for the prevention, treatment and care of populations affected by exposure to mercury and mercury compounds. • Develop and strengthen institutional and professional medical capacity to prevent, diagnose, treat and monitor health risks associated with exposure to mercury and mercury compounds.
Existing policies and regulations that will enable the country to comply with the above provisions:	
Relevant regulatory legal acts	• Code of the Republic of Kazakhstan No. 193-IV of 18 September 2009 «On public health and the health care system» (the document contains an indication that the State guarantees the citizens of the Republic of Kazakhstan sanitary-epidemiological, ecological well-being and radiation safety). • Order No. 151 of 9 November 2016 of the Chairman of the Committee on Water Resources of the Ministry of Agriculture of the Republic of Kazakhstan «On approval of a unified system of water quality classification in water bodies» (this document contains standards for mercury content in water). • Decision of the Customs Union Commission of December 9, 2011 № 880 «On the adoption of technical regulations of the Customs Union» On food safety (this document approved the norms of mercury content in food products (meat, poultry, eggs, dairy, fish products, cereals, sugar, vegetables, cereals, etc.). • Order of the Minister of Health of the Republic of Kazakhstan dated 8 September 2017 No. 684 «On Approval of Sanitary Regulations «Sanitary and Epidemiological Requirements for

	Laboratories Using Potentially Hazardous Chemical and Biological Substances» (this document contains a description of the procedure for demercurization in the event of a mercury spill).
Specific regulatory or policy aspects to be addressed / developed to ensure compliance with the Convention	
• Consideration of the relevance of developing a health screening program for the population living in the regions of historical mercury pollution.	

Article 17: Information exchange	
Article description	
List of activities under relevant article	• Creation of a National Focal Point for information exchange.
Existing policies and regulations that will enable the country to comply with the above provisions:	
Relevant regulatory legal acts	• There are no legal acts regulating the implementation of this article.
Specific regulatory or policy aspects to be addressed / developed to ensure compliance with the Convention	
• Currently, the Republic of Kazakhstan is working on the establishment of the Coordination Centre for three chemical conventions (Basel, Rotterdam, Stockholm) based on JSC «Zhasyl Damu».	

Article 18: Public information, awareness and education	
Article description	
List of activities under relevant article	• Providing the public with reliable information to ensure public awareness of the effects of exposure to mercury and mercury compounds on human health and the environment.
Existing policies and regulations that will enable the country to comply with the above provisions:	
Relevant regulatory legal acts	• In 2000, the Republic of Kazakhstan ratified the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention), which is the basis for informing, raising awareness and educating the public about environmental issues.
Specific regulatory or policy aspects to be addressed / developed to ensure compliance with the Convention	
• Relevant in this case may be the involvement of the most active representatives of civil society in addressing the issues of mercury and mercury waste management, as well as to work with the public to increase their awareness of the impact of mercury on health and the environment.	

• Taking into account different levels of knowledge and public interest, it is recommended to organize individual materials and forms of work for each target group (teachers, schoolchildren, students, doctors, government officials, researchers, etc.). • These activities should be envisaged when updating the Plan of implementation of obligations under the Minamata Convention.

Article 19: Research, development and monitoring	
Article description	
List of activities under relevant article	• Development and improvement of inventories of use, consumption and anthropogenic emissions of mercury and mercury compounds. • Assessment of the impact of mercury and mercury compounds on human health and the environment.
Existing policies and regulations that will enable the country to comply with the above provisions:	
Relevant regulatory legal acts	• There are no regulatory legal acts regulating the implementation of this article.
Specific regulatory or policy aspects to be addressed / developed to ensure compliance with the Convention	
• One solution to this issue may be to consider the possibility of including this type of research in the state social order and scientific research programs. Local research institutes, non-governmental organizations, and consulting companies may become the executors of these studies through a call for proposals and analysis of project applications.	

Article 20: Implementation plans	
Article description	
List of activities under relevant article	• Development of a plan of implementation of obligations under the Minamata Convention.
Existing policies and regulations that will enable the country to comply with the above provisions:	
Relevant regulatory legal acts	• The draft of the Minamata Convention Obligations Implementation Plan was developed within the framework of the GEF/UNDP project «Updating of the National Implementation Plan, integration of Persistent Organic Pollutants Management into the process of national planning and rational management of medical waste in Kazakhstan». The document was submitted to the Ministry of Energy of the Republic of Kazakhstan.
Specific regulatory or policy aspects to be addressed / developed to ensure compliance with the Convention	
• The Plan should be audited and updated as necessary.	

Article 21: Reporting

Article description	
List of activities under relevant article	• Reporting to the Conference of the Parties on measures taken to implement the provisions of the Convention.
Existing policies and regulations that will enable the country to comply with the above provisions:	
Relevant regulatory legal acts	• There are no normative legal acts regulating the implementation of this article.
Specific regulatory or policy aspects to be addressed / developed to ensure compliance with the Convention	
• Determination of the structural subdivision of the Ministry of Energy of the Republic of Kazakhstan responsible for providing the Conference of the Parties with information on measures taken to implement the provisions of the Minamata Convention.	

3.2 Institutional evaluation

Article 3: Mercury supply sources and trade	
Article description	
List of activities under relevant article	• Prohibition of primary mercury mining. • Primary mercury mining for a period of up to 15 years (if it was carried out on its territory). • Identification of individual stockpiles of mercury or mercury compounds in excess of 50 metric tons, as well as sources of mercury supply, providing for the creation of stockpiles of mercury in excess of 10 metric tons per year. • Prohibition of mercury exports. • Prohibition of the import of mercury from a State that is not a party to the Convention.
Relevant national stakeholders:	
1. Name of the institution/stakeholder: State Revenue Committee of the Ministry of Finance of the Republic of Kazakhstan Role with respect to the above provisions	• **Role with respect to the above provisions:** • Development of the Features of Application of the Customs Transit Procedure in respect of goods transported through the territory of the Republic of Kazakhstan. • Development of a classifier of codes confirming the compliance with prohibitions and restrictions used in customs declaration, the formation of an identification customs number, the nature of the transaction, the peculiarities of the foreign trade transaction. • Development of rules for maintaining customs statistics of foreign trade in goods of the Republic of Kazakhstan with states that are not members of the Eurasian Economic Union. • Implementation and improvement of customs declaration, customs control, as well as the creation of conditions conducive to the simplification of customs operations in respect of goods and vehicles transported across the customs border of the Eurasian Economic Union. • Coordination of control over the movement of goods across the State border of the Republic of Kazakhstan.

	Appropriate institutional capacity to comply with the above provisions: • Available legislative, organizational and technical resources to control the export and import of mercury. • Access to information on import and export of mercury. • Possibility to develop regulations governing the import and export of mercury.
2. Name of the institution/stakeholder: Ministry of Energy of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Implementation of the state policy on international cooperation in the areas within the competence of the Ministry.
	Appropriate institutional capacity to comply with the above provisions: • The possibility of monitoring the implementation of obligations under this article. • Availability of authority for interagency cooperation on this issue.
3. Name of the institution/stakeholder: Ministry of Industry and Infrastructure Development of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Approval of the accounting treatment of certain types of chemical products. • Approval of the procedure for registration and accounting of chemical products.
	Appropriate institutional capacity to comply with the above provisions: • Rules for the transportation of dangerous goods on the territory of the Republic of Kazakhstan established by law. • Availability of mechanisms for control over the procedure of registration of imported and exported chemical products.
Remaining gaps at the national level that need to be addressed before the obligations under the relevant article can be fulfilled:	
• Enhancing the capacity of customs officials to detect contraband. • Development of appropriate regulations for use in the Customs Union.	

Article 4: Mercury-added products	
Article description:	
List of activities under the relevant article	• Prohibition of production, import or export of mercury-added products. • Taking action on mercury-added products. • Countering the production and distribution of mercury-added products through the mercury trade system.
Relevant national stakeholders:	
	Role in relation to the above provisions:

1. Name of the institution/stakeholder: State Revenue Committee of the Ministry of Finance of the Republic of Kazakhstan	• Development of a classifier of codes confirming compliance with prohibitions and restrictions used in customs declaration, the formation of an identification customs number, the nature of the transaction, and the peculiarities of the foreign trade transaction. • Development of rules for maintaining customs statistics of foreign trade in goods of the Republic of Kazakhstan with states that are not members of the Eurasian Economic Union. • Coordination of control over the movement of goods across the State border of the Republic of Kazakhstan. • Development of draft regulatory legal acts and international treaties of the Republic of Kazakhstan within the competence of the Committee.
	Appropriate institutional capacity to comply with the above provisions: • Available legislative, technical and human resources to control the export and import of mercury-containing products. • Access to information on import and export of mercury-containing products. • Possibility to develop regulations governing import and export procedures for mercury-containing products.
2. Name of the institution/stakeholder: Public Health Protection Committee of the Ministry of Health of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Ensuring sanitary and epidemiological well-being of the population. • Prohibition of import, production, use and sale on the territory of the Republic of Kazakhstan of products intended for use and application by the population, as well as in entrepreneurial and (or) other activities in the order established by the legislation of the Republic of Kazakhstan. • Implementation of sanitary and epidemiological measures to prevent the importation and trafficking of products (goods) dangerous to life, health and the environment controlled by the state sanitary and epidemiological supervision (control).
	Appropriate institutional capacity to comply with the above provisions: • Availability of authority for product quality control at the stages of import and distribution. • Competencies available to develop and implement measures to limit the use of mercury-containing products. • Availability of an appropriate legal and regulatory framework.
3. Name of the institution/stakeholder: Ministry of National Economy of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Monitoring by analysing the information on the issued certificates of origin of goods submitted quarterly by territorial chambers of commerce and industry, as well as monitoring the issuance of the certificate of origin of goods

	for internal circulation, determining the status of goods of the Customs Union and (or) foreign goods by the authorized body (organization).
	Appropriate institutional capacity to comply with the above provisions: • Availability of powers to carry out accounting of imported and exported products.
4. Name of the institution/stakeholder: Ministry of Industry and Infrastructure Development of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Approval of the accounting treatment of certain types of chemical products. • Approval of the procedure for registration and accounting of chemical products.
	Appropriate institutional capacity to comply with the above provisions: • Existence of the authority to control the procedure of registration of imported and exported chemical products.
Remaining gaps at the national level that need to be addressed before the obligations under the relevant article can be fulfilled:	
• Enhancing the capacity of customs officials to detect contraband. • Development of appropriate regulations for use in the Customs Union. • Approval of the form and rules for drafting the Safety Data Sheet for chemical products. • Ensuring open access to the register of potentially hazardous chemicals.	

Article 5: Manufacturing processes in which mercury or mercury compounds are used	
Article description:	
List of activities under relevant article	• Prohibition of the use of mercury or mercury compounds in industrial processes. • Adoption of measures to restrict the use of mercury or mercury compounds in processes. • Prohibition of the use of mercury or mercury compounds in facilities that did not exist before the date of entry into force of the Convention.
Relevant national stakeholders:	
1. Name of the institution/stakeholder: Industrial Development and Industrial Safety Committee of the Ministry of Industry and Infrastructure Development of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Registration of chemical products on the territory of the Republic of Kazakhstan and keeping its records. • Approval of the procedure for accounting for certain types of chemical products.
	Appropriate institutional capacity to comply with the above provisions: • Availability of authorities for accounting of products produced with the use of mercury or mercury compounds.
	Role with respect to the above provisions:

2. Name of the institution/stakeholder: Committee on Emergency Situations of the Ministry of Internal Affairs of the Republic of Kazakhstan	• Implementation of information and analytical activities in the field of civil protection. • Coordination of the activities of rescue services and formations. • Organization of interaction with government agencies, organizations for exchange of information on the threat and occurrence of natural and manufactured disasters from monitoring systems, including those using remote sensing of land. • Organization of propaganda of knowledge, training of population and specialists in the field of civil protection. • Provision of communication with the public and mass media on issues related to civil protection. • Carrying out rescue and emergency operations in case of emergency situations.
	Appropriate institutional capacity to comply with the above provisions: • Availability of authority to exercise control over the observance of safety at work. • Availability of resources for the agency to carry out liquidation of consequences of manufactured emergencies. • Established mechanisms for inter-agency cooperation on industrial safety issues.
3. Name of the institution/stakeholder: Ministry of Health of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Definition of hazard classes of wastes by their degree of impact on humans and the environment (toxicity). • Prohibition of production, use and sale of new types of raw materials, products, chemicals, technological equipment, mechanisms, processes, tools, in case they are recognized as hazardous to human life and health. • Control and supervision of compliance with the requirements established by technical regulations and regulatory documents on products and services sold to consumers. • Maintaining a register of potentially hazardous chemical and biological substances prohibited for use in the Republic of Kazakhstan.
	Appropriate institutional capacity to comply with the above provisions: • Availability of capacity for prevention, diagnosis, treatment and rehabilitation of occupational diseases. • Opportunity for treatment and rehabilitation of the population, as well as employees of the enterprise in case of emergency situations at work. • Ability to organize and conduct preventive examinations of the population and employees of the enterprises.
	Role in relation to the above provisions:

4. Name of the institution/stakeholder: Ministry of Labor and Social Protection of the Republic of Kazakhstan	• Formation and implementation of state policy, implementation of inter-sectoral coordination and state management in the field of labor, including safety and labor protection. • Implementation of methodological and organizational coordination of the work of authorized state bodies, social services in the field of labour, safety and labour protection, employment, social security, social protection of disabled people, provision of social assistance and special social services.
	Appropriate institutional capacity to comply with the above provisions: • Availability of powers to ensure social guarantees for workers at work • Availability of mechanisms to control compliance with occupational safety and health.
Remaining gaps at the national level that need to be addressed before obligations under the relevant article can be fulfilled:	
• Development of a plan to reduce the use of mercury processes. • Identify and implement available alternatives to reduce mercury production in a phased manner.	

Article 8: Emissions	
Article description:	
List of activities under the relevant article	• Adoption of measures to control emissions. • Preparation of a national plan setting out the measures to be taken to control emissions and the expected targets, objectives and results. • Reduction of emissions using best available techniques and best environmental practices (no later than 5 years after the date of entry into force of the Convention). • Setting quantitative targets to monitor emission reductions from relevant sources. • Setting limits
Relevant national stakeholders:	
1. Name of the institution/stakeholder: Ministry of Energy of the Republic of Kazakhstan	**Role in relation to the above provisions:** • To coordinate the activities of central and local executive bodies in the implementation of state policy in regulated areas.
	Appropriate institutional capacity to comply with the above provisions: • Availability of authority for environmental policy making. • Availability of subordinate organizations performing the functions of information collection and control.
	Role in relation to the above provisions:

2. Name of institution/stakeholder: Committee for Environmental Regulation and Control of the Ministry of Energy of the Republic of Kazakhstan	• Exercising control over the activities of local executive bodies, legal entities and individuals within its competence. • Exercise state environmental control over the implementation of measures to eliminate the consequences of environmental pollution. • Improvement of laboratory and analytical control services in the system of state environmental control bodies.
	Appropriate institutional capacity to comply with the above provisions: • Availability of authorities for emission control functions.
3. Name of institution/stakeholder: Kazhydromet	**Role in relation to the above provisions:** • Conducting systematic observations of the state of the atmosphere, surface water, crops and pastures, radiation situation on the land surface.
	Appropriate institutional capacity to comply with the above provisions: • Availability of laboratory and analytical control service for emissions from enterprises. • Availability of authority and technical capabilities for information collection and reporting at the national level.
4. Name of the institution/stakeholder: Public Health Protection Committee of the Ministry of Health of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Ensuring sanitary and epidemiological well-being of the population.
	Appropriate institutional capacity to comply with the above provisions: • Availability of authority and technical capacity for information collection and reporting in the context of public health.
Remaining gaps at the national level that need to be addressed before the obligations under the relevant article can be fulfilled:	
• Enabling systematic monitoring of mercury (development of appropriate regulatory framework, equipping of laboratories, training of specialists, accreditation of laboratories). • Consider preparing a national plan setting out the measures to be taken to control emissions, as well as a national plan that includes measures to control mercury emissions and expected targets, objectives and results.	

Article 9: Releases	
Article description:	
List of activities under relevant article	• Identification of relevant point source categories on a regular basis (no later than 3 years after the date of entry into force of the Convention). • Preparation of the National Mercury Release Control Plan and expected targets, objectives and results.

	• Maintenance of an inventory of releases from relevant sources.
Relevant national stakeholders:	
1. Name of institution/stakeholder: Ministry of Energy of the Republic of Kazakhstan	**Role in relation to the above provisions:** • To coordinate the activities of central and local executive bodies in the implementation of state policy in regulated areas.
	Appropriate institutional capacity to comply with the above provisions: • Availability of authority for environmental policy making. • Availability of subordinate organizations performing the functions of information collection and control.
2. Name of institution/stakeholder: Committee for Environmental Regulation and Control of the Ministry of Energy of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Exercising control over the activities of local executive bodies, legal entities and individuals within its competence. • Exercise state environmental control over the implementation of measures to eliminate the consequences of environmental pollution. • Exercise state environmental control over the implementation of a set of measures to improve land, prevent and eliminate the consequences of processes causing land degradation, restoration and preservation of soil fertility. • Improvement of activity of laboratory and analytical control services in the system of state environmental control bodies.
	Appropriate institutional capacity to comply with the above provisions: • Availability of authority to carry out release control functions.
3. Name of institution/stakeholder: Kazhydromet	**Role with respect to the above provisions:** • Conducting systematic observations of the state of the atmosphere, surface water, crops and pastures, radiation situation on the land surface.
	Appropriate institutional capacity to comply with the above provisions: • Availability of laboratory and analytical control service for emissions from enterprises. • Availability of authority and technical capabilities for information collection and reporting at the national level.
4. Name of the institution/stakeholder: Public Health Protection Committee of the Ministry of Health of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Ensuring sanitary and epidemiological well-being of the population.
	Appropriate institutional capacity to comply with the above provisions:

	• Availability of authority and technical capacity for information collection and reporting in the context of public health.
Remaining gaps at the national level that need to be addressed before the obligations under the relevant article can be fulfilled:	
• Enabling systematic monitoring of mercury (development of appropriate regulatory framework, equipping of laboratories, training of specialists, accreditation of laboratories). • Consider preparing a national plan outlining the measures to be taken to control releases, as well as a national plan that includes measures to control releases of mercury and expected targets, goals and results. • Consider the possibility of creating an inventory of mercury emissions and a cadastre of releases from relevant sources or integrating these sections into Kazakhstan's existing system of state registration of environmental pollution sites, the state inventory of production wastes and consumption, taking into account the methodology of cadastre formation.	

Article 10: Environmentally sound interim storage of mercury, other than waste mercury	
Article description	
List of activities under relevant article	• Adopt measures for the environmentally sound storage of mercury and mercury compounds.
Relevant national stakeholders:	
1. Name of the institution/stakeholder: Committee for Environmental Regulation and Control of the Ministry of Energy of the Republic of Kazakhstan	**Role with respect to the above provisions:** • Control over the activities of local executive bodies, legal entities and individuals within its competence. • Compliance with the rules of use, storage, transportation, burial, disposal or other handling of radioactive and other environmentally hazardous substances in terms of environmental requirements to prevent environmental pollution. • Compliance with the established norms and rules for the use, storage and transportation of chemical and biological substances.
	Appropriate institutional capacity to comply with the above provisions: • Availability of authority to exercise control over the activities of local executive bodies, legal entities engaged in mercury storage.
2. Name of the institution/stakeholder: Emergency Committee of the Ministry of Internal Affairs of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Coordination of emergency services and formations. • Organization of interaction with government agencies, organizations for exchange of information on the threat and occurrence of natural and manufactured disasters from monitoring systems, including those using remote sensing of land.

	• Carrying out rescue and emergency operations in case of emergency situations.
	Appropriate institutional capacity to comply with the above provisions: • Availability of technical facilities and powers for liquidation of emergency situations consequences in mercury storage areas.
Remaining gaps at the national level that need to be addressed before obligations under the relevant article can be fulfilled:	
• Finding ways to implement existing mercury stockpiles. • Improved ways of transferring mercury to interim storage.	

Article 11: Mercury wastes	
Article description	
List of activities under relevant article	• Development of methods of regeneration, recycling, recovery or reuse of mercury wastes. • Prohibition of movement of mercury wastes across international borders (except for environmentally sound disposal).
Relevant national stakeholders:	
1. Name of the institution/stakeholder: Ministry of Energy of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Implementation of the state policy on international cooperation in the areas within the competence of the Ministry. • To coordinate the activities of central and local executive bodies in the implementation of state policy in regulated areas.
	Appropriate institutional capacity to comply with the above provisions: • Possibility of amendments to the relevant regulatory legal acts. • Availability of the authority to define the state policy in terms of mercury waste management. • Availability of authorities for coordination of activities of organizations and stakeholders in the field of mercury waste management.
2. Name of the institution/stakeholder: JSC «Zhasyl Damu»	**Role in relation to the above provisions:** • Inventory of ownerless waste and state registration (including mercury waste, PCBs, pesticides, etc.). • Development of comprehensive measures and projects for the destruction and disposal of economically unattractive types of waste. • Professional support of international conventions from the Republic of Kazakhstan (Stockholm, Basel, Rotterdam, Vienna Conventions, Convention on Long-range

	Transboundary Air Pollution, Montreal Protocol for the Protection of the Ozone Layer).
	Relevant institutional capacity to comply with the above provisions: • An organization whose main purpose is waste management in the Republic of Kazakhstan. • Availability of intellectual capacity to represent the country at the international level. • Availability of opportunities to participate in law-making activities taking into account knowledge of specific features of mercury waste management.
3. Name of the institution/stakeholder: Committee for Environmental Regulation and Control of the Ministry of Energy of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Control over the activities of local executive bodies, legal entities and individuals within its competence. • Exercise state environmental control over the implementation of measures to eliminate the consequences of environmental pollution. • Exercise state environmental control over the implementation of a set of measures to improve land, prevent and eliminate the consequences of processes causing land degradation, restoration and preservation of soil fertility. • Exercise state environmental control over compliance with the rules of use, storage, transportation, burial, utilization or other circulation of radioactive and other environmentally hazardous substances in terms of environmental requirements for the prevention of environmental pollution. • Exercise state environmental control over compliance with established norms and rules on application, storage, transportation of chemical and biological substances. • Exercise state environmental control over compliance with established norms and rules of accounting, utilization and neutralization of production and consumption wastes.
	Appropriate institutional capacity to comply with the above provisions: • Availability of authority to exercise control over organizations engaged in storage of mercury wastes. • Availability of established mechanisms for collection and processing of information.
4. Name of the institution/stakeholder: Committee on Emergency Situations of the Ministry of Internal Affairs of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Coordination of emergency services and formations. • Organization of interaction with government agencies, organizations for exchange of information on the threat and occurrence of natural and manufactured disasters from monitoring systems, including those using remote sensing of land. • Carrying out rescue and emergency operations in case of emergency situations.

	Appropriate institutional capacity to comply with the above provisions: • Availability of technical means and authority to deal with emergency situations at mercury waste storage sites.
Remaining gaps at the national level that need to be addressed before the obligations under the relevant article can be fulfilled:	
• Normative fixation of the concept of «mercury wastes». • Separate collection of hazardous wastes containing mercury. • Establishment and operation of hazardous waste collection points. • Identification and transfer of ownerless hazardous wastes to the state ownership. • Development of mechanisms for processing or sale of mercury wastes.	

Article 12: Contaminated sites	
Article description	
List of activities under relevant article	• Development of strategy for identification and assessment of sites contaminated with mercury or mercury compounds.
Relevant national stakeholders:	
1. Name of the institution/stakeholder: Committee for Environmental Regulation and Control of the Ministry of Energy of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Control over the activities of local executive bodies, legal entities and individuals within its competence. • Exercise state environmental control over the implementation of measures to eliminate the consequences of environmental pollution. • Exercise state environmental control over the implementation of a set of measures to improve land, prevent and eliminate the consequences of processes causing land degradation, restoration and preservation of soil fertility. • Improvement of activity of laboratory and analytical control services in the system of state environmental control bodies.
	Appropriate institutional capacity to comply with the abovementioned provisions: • Availability of authorities for development of measures to reduce the impact of mercury-contaminated sites on the environmental situation in the region. • Possibility to carry out state environmental control over the implementation of measures to eliminate the consequences of environmental pollution.
2. Name of the institution/stakeholder: Regional Akimats	**Role in relation to the above provisions:** • Participation in the implementation of the main directions of domestic and foreign policy of the President, the Government of the Republic of Kazakhstan by participating in the development of the forecast of socio-economic development of the region, ensuring and monitoring the implementation of state programs and the forecast of socio-

	economic development, development of proposals within its competence. • Coordination of the activities of enterprises, organizations and institutions of republican subordination in accordance with the powers delegated by the central executive body, ensuring interaction and coordination of the activities of state bodies funded from the regional budget, territorial bodies of republican subordination.
	Appropriate institutional capacity to comply with the above provisions: • Availability of authority to develop measures to reduce the impact of mercury-contaminated sites on the environmental situation in the region. • Possibility to perform coordination function in the course of interaction between different departments of the region. • Availability of authorities for regional budget management aimed at elimination of environmental pollution consequences.
3. Name of the institution/stakeholder: Regional Environmental Departments of the Environmental Regulation and Control Committee of the Ministry of Energy of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Interaction and cooperation with public associations in the field of environmental protection, within its competence. • To exercise control over the activities of individuals and legal entities within the scope of their competence. • Exercising control over the activities of local executive bodies on matters within the Department's competence. • Provision of access to environmental information within its competence in the order established by the legislation of the Republic of Kazakhstan. • Implementation of state environmental control over the implementation of a set of measures to improve land, prevent and eliminate the consequences of processes causing land degradation, restoration and preservation of soil fertility. • Improvement of activity of laboratory and analytical control services in the system of state environmental control bodies.
	Appropriate institutional capacity to comply with the abovementioned provisions: • Availability of authorities for control over the process of elimination of consequences of environmental pollution. • Presence in the structure of the department of the subdivision responsible for the implementation of laboratory control of the environment.
4. Name of the institution/stakeholder: Ministry of Health of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Maintaining a register of potentially hazardous chemicals and biological substances prohibited for use in the Republic of Kazakhstan.

	Appropriate institutional capacity to comply with the above provisions: • Implementation of the process of prevention, diagnosis and treatment of health effects of the population living in the area of environmental pollution. • Possibility to implement screening programmes.
Remaining gaps at the national level that need to be addressed before the obligations under the relevant article can be fulfilled:	
• Updating the boundaries of historical mercury pollution areas (Karaganda and Pavlodar regions). • Consideration of the need to develop and implement measures to reduce the impact of mercury pollution in the planning of the local budget of the region.	

Article 13: Financial resources and mechanism	
Article description	
List of activities under relevant article	• Ensuring that resources are made available to meet the obligations of the Convention.
Relevant national stakeholders:	
1. Name of the institution/stakeholder: Government of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Management of ministries, government committees, other central and local executive bodies.
	Appropriate institutional capacity to comply with the above provisions: • Having the authority to plan and approve the state budget. • Existence of authority to initiate and approve departmental state programs.
Remaining gaps at the national level that need to be addressed before obligations under the relevant article can be fulfilled:	
• Consideration of the need to fulfill obligations under the Minamata Convention in the planning of the national budget.	

Article 14: Capacity-building, technical assistance and technology transfer	
Article description	
List of activities under relevant article	• Development, transfer and dissemination of modern environmentally sound alternative technologies.
Relevant national stakeholders:	
1. Name of the institution/stakeholder: Ministry of Energy of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Implementation of the state policy on international cooperation in the areas within the competence of the Ministry. • Coordination of the activities of central and local executive bodies for the implementation of state policy in regulated areas.

	Appropriate institutional capacity to comply with the above provisions: • Availability of authority for adaptation and introduction of modern environmentally sound technologies. • Availability of proven mechanisms for international cooperation in terms of technology transfer.
Remaining gaps at the national level that need to be addressed before obligations under the relevant article can be fulfilled:	
• Collection of information and assessment of the possibility of introducing modern environmentally sound technologies. • Budget planning for the introduction of modern environmentally sound technologies.	

Article 16: Health aspects	
Article description	
List of activities under relevant article	• Promoting the development and implementation of strategies and programmes to identify and protect the public from exposure to mercury and mercury compounds. • Provide appropriate health services for the prevention, treatment and care of populations affected by exposure to mercury and mercury compounds. • Develop and strengthen institutional and professional medical capacity to prevent, diagnose, treat and monitor health risks associated with exposure to mercury and mercury compounds.
Relevant national stakeholders:	
1. Name of institution/stakeholder: Ministry of Health of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Protection of public health, sanitary-epidemiological well-being of the population, medical and pharmaceutical science, medical and pharmaceutical education, circulation of medicines, medical devices and medical equipment, quality control of medical services. • Ensuring, in accordance with the legislation of the Republic of Kazakhstan, that citizens receive free medical care within the scope guaranteed by the state. • Organization of provision of the population and health care organizations with safe, effective and quality medicines. • Implementation of inter-sectoral coordination of the activities of state bodies to ensure the implementation of state policy in the field of protection of sanitary-epidemiological well-being of the population.
	Appropriate institutional capacity to comply with the above provisions: • Availability of powers for prevention, diagnostics and treatment of diseases, carrying out rehabilitation measures. • Possibility to initiate the development and implementation of state health care programs.

	• Availability of well-equipped clinics of the republican level in direct subordination.
2. Name of the institution/stakeholder: Public Health Protection Committee of the Ministry of Health of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Ensuring sanitary and epidemiological well-being of the population.
	Appropriate institutional capacity to comply with the above provisions: • Availability of authority and technical capacity to control the chemical content of products, workplaces and living quarters.
3. Name of the institution/stakeholder: Regional Akimats	**Role in relation to the above provisions:** • Participation in the implementation of the main directions of domestic and foreign policy of the President, the Government of the Republic of Kazakhstan by participating in the development of the forecast of socio-economic development of the region, providing and monitoring the implementation of state programs and the forecast of socio-economic development, development of proposals within its competence. • Coordination of the activities of enterprises, organizations and institutions of republican subordination in accordance with the powers delegated by the central executive body, ensuring interaction and coordination of the activities of state bodies funded from the regional budget, territorial bodies of republican subordination.
	Appropriate institutional capacity to comply with the above provisions: • Control over the activities of medical organizations in the region through monitoring the activities of regional health departments, which directly subordinate all medical organizations in the region. • Possibility to initiate the implementation of screening activities and prevention programs at the regional level.
Remaining gaps at the national level that need to be addressed before obligations under the relevant article can be fulfilled:	
• Consideration of the possibility of assessing the health of the population living in areas of historical mercury pollution.	

Article 17: Information exchange	
Article description:	
List of activities under relevant article	• Creation of a National Focal Point for information exchange.
Relevant national stakeholders:	
	Role in relation to the above provisions:

1. Name of the institution/stakeholder: Ministry of Energy of the Republic of Kazakhstan	• Implementation of the state policy on international cooperation in the areas within the competence of the Ministry. • Development of the system of information dissemination and education in the field of environmental protection.
	Appropriate institutional capacity to comply with the above provisions: • Availability of potential for international cooperation. • Presence of subordinated organizations responsible for collection and analysis of environmental information both at the regional and national levels.
2. Name of the institution/stakeholder: Kazhydromet	**Role in relation to the above provisions:** • Preparation and publication of scientific, technical and applied literature on the state of the environment, climatic and agro climatic conditions and water resources on the territory of the Republic of Kazakhstan, on the hydro meteorological regime of surface waters.
	Appropriate institutional capacity to comply with the above provisions: • Availability of technical means for collection and analysis of information at the national level.
Remaining gaps at the national level that need to be addressed before obligations under the relevant article can be fulfilled:	
• Defining the list of state bodies and subordinate organizations that will be involved in this process. • Defining the powers and scope of information collected and presented by each participant in the process. • Strengthening of international and regional partnership in the field of discussion and adoption of measures aimed at solving problems related to mercury, exchange of information on technological innovations, economically and technically feasible mercury-free alternatives, possible measures and methods to reduce and eliminate the use of mercury and mercury compounds.	

Article 18: Public information, awareness and education	
Article description:	
List of activities under relevant article	• Providing the public with reliable information to ensure public awareness of the effects of exposure to mercury and mercury compounds on human health and the environment.
Relevant national stakeholders:	
1. Name of the institution/stakeholder: Ministry of Energy of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Implementation of the state policy on international cooperation in the areas within the competence of the Ministry. • Development of the system of information dissemination and education in the field of environmental protection.

	Appropriate institutional capacity to comply with the above provisions: • Availability of an elaborated procedure of annual issue of information collections of the Ministry of Energy.
2. Name of the institution/stakeholder: Ministry of Health of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Formation and implementation of the state social order for research, information and education, and consulting assistance to the population on ensuring the sanitary-epidemiological well-being of the population.
	Appropriate institutional capacity to comply with the above provisions: • Availability of a subordinate organization «National Centre for Public Health», the main purpose of which is to work with the population in terms of information and formation of a healthy lifestyle. • Availability of organizational mechanisms for dissemination of information through a network of medical organizations throughout the country.
3. Name of the institution/stakeholder: Committee on Emergency Situations of the Ministry of Internal Affairs of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Organization of knowledge raising, public education and training of civil protection professionals. • Providing public relations and media relations on civil protection issues.
	Appropriate institutional capacity to comply with the above provisions: • Positive experience in developing information materials for the public, • Availability of proven channels of information dissemination.
3. Name of institution/stakeholder: Regional Aarhus Centres	**Role in relation to the above provisions:** • Conducting informational and advisory work. • Conducting educational activities (trainings, seminars, lectures). • Implementation of environmental education and propaganda.
	Appropriate institutional capacity to comply with the above provisions: • Presence of positive experience of work with non-governmental organizations. • Availability of an opportunity to receive reliable information at the international level in a timely manner.
Remaining gaps at the national level that need to be addressed before obligations under the relevant article can be fulfilled:	

• Currently, various agencies are working to inform the public and use various channels to deliver information. • Consideration of the possibility of developing and implementing training and prevention programs regarding the impact of mercury and mercury compounds in the workplace; improving the quality of medical services for the prevention, treatment and care of populations affected by mercury and mercury compounds; and strengthening institutional and professional medical capacity.

Article 19: Research, development and monitoring	
Article description	
List of activities under relevant article	• Development and improvement of inventories of use, consumption and anthropogenic emissions of mercury and mercury compounds. • Conducting an assessment of the impact of mercury and mercury compounds on human health and the environment.
Relevant national stakeholders:	
1. Name of the institution/stakeholder: Ministry of Education and Science of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Formation of a unified state policy in the field of education, science and technology. • Development of normative legal acts in the field of scientific and technical activity. • Approval of the order of organization and conduct of scientific research and development work on the basis of public-private partnership. • Development of priority directions of fundamental and applied scientific research in the Republic of Kazakhstan. • Organization of development of scientific, scientific and technical projects and programs of fundamental and applied scientific research, implemented at the expense of the state budget at the stages of formation, execution and completion. • Implementation of international cooperation in the field of science and scientific-technical activity.
	Appropriate institutional capacity to comply with the above provisions: • This department is the main organization that controls and coordinates the conduct of scientific research and the introduction of scientific developments at the national level. • Availability of powers for formation of the national policy in the field of science and education. • Availability of authorities for introduction of separate educational (environmental) components in curricula at schools, colleges, universities.
2. Name of the institution/stakeholder: Ministry of Health of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Prioritization of scientific developments, organization of scientific research and coordination of scientific support in the field of health care, development of the concept of medical science;

	• Formation and implementation of the state social order for research, awareness raising and consulting assistance to the population on the issues of ensuring the sanitary-epidemiological well-being of the population.
	Appropriate institutional capacity to comply with the above provisions: • Availability of opportunities for implementation of scientific projects and introduction of new developments in subordinate research institutes. • Availability of the possibility to conduct separate scientific researches within the framework of Master's and Doctoral programs in coordination with the Ministry of Education and Science.
Remaining gaps at the national level that need to be addressed before obligations under the relevant article can be fulfilled:	
• Planning research related to the assessment of the impact of mercury on the environment and public health. • Planning of the research budget.	

Article 20: Implementation plans	
Article description	
List of activities under relevant article	• Elaboration of a plan for implementation of obligations under the Minamata Convention.
Relevant national stakeholders:	
1. Name of the institution/stakeholder: Ministry of Energy of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Implementation of the state policy on international cooperation in the areas within the competence of the Ministry.
	Appropriate institutional capacity to comply with the above provisions: • Availability of authorities for development of the Plan of implementation of obligations under the Minamata Convention, its coordination with ministries, departments and stakeholders, control over its implementation.
Remaining gaps at the national level that need to be addressed before obligations under the relevant article can be fulfilled:	
Conducting an inventory of mercury in the Republic of Kazakhstan, forming a list of interested state bodies, identifying responsible executors in order to include this information in the Plan of implementation of obligations under the Minamata Convention.	

Article 21: Reporting	
Article description	
List of activities under relevant article	• Reporting to the Conference of the Parties on measures taken to implement the provisions of the Convention.

Relevant national stakeholders:	
1. Name of the institution/stakeholder: Ministry of Energy of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Implementation of the state policy on international cooperation in the areas within the competence of the Ministry.
	Appropriate institutional capacity to comply with the above provisions: • Availability of authorities and organizational capacities for collection of necessary information, control of its reliability and formation of reporting forms.
2. Name of the institution/stakeholder: Ministry of Foreign Affairs of the Republic of Kazakhstan	**Role in relation to the above provisions:** • Ensuring the participation of the Republic of Kazakhstan in the activities of international organizations, conferences, meetings, forums, promoting the role of the Republic of Kazakhstan, as a member of the international community, in solving global and regional problems.
	Appropriate institutional capacity to comply with the above provisions: • Availability of authority for interaction with the Secretariat of the Minamata Convention at the diplomatic level. • Availability of authority to carry out interagency cooperation and coordination work in order to meet the commitments undertaken.
Remaining gaps at the national level that need to be addressed before obligations under the relevant article can be fulfilled:	
• Formation of an algorithm for collection, formation, analysis and submission of information to the Secretariat of the Minamata Convention.	

Chapter IV: Identification of populations at risks and gender dimensions

4.1 Population health risk assessment

All people are exposed to low levels of mercury. Generally, these low exposures cannot cause adverse health effects. However, mercury can have a significant adverse effect on human health if exposure levels exceed established safe levels.

Factors determining the occurrence of adverse health effects and their health effects are: the chemical form of the mercury, the dose, the age of the person exposed (susceptible developing systems), the duration of exposure, the route of exposure (inhalation, ingestion or skin contact), and dietary patterns of consumption of fish and seafood.

Quality of life and health issues are priorities and require, according to UN experts, close attention from governments and the public in all countries[11].

The main targets for exposure to mercury and its compounds are the nervous system, kidneys and the cardiovascular system. It is generally accepted that developing organ systems (such as the foetal nervous system) are the most sensitive to the toxic effects of mercury. Methylmercury levels in the foetal brain are higher than in maternal blood, and the developing central nervous system of the foetus is now seen as the system of greatest concern because it demonstrates the greatest sensitivity. It should be noted, however, that the nervous system continues to develop during adolescence. Other systems that may be affected include the respiratory, haematological, immune and reproductive systems and the gastrointestinal tract.

People may be exposed to any form of mercury in different circumstances. However, in Kazakhstan, the main impacts occur during the consumption of methylmercury-contaminated fish for food and when workers inhale elemental mercury while working in metal production. Mercury may be emitted during the mining and processing cycle of minerals (copper, gold, lead, etc.) and therefore poses a potential hazard to those living and working near mining and processing areas. At the same time, it should be noted that there is no relevant information on the occupational health effects of mercury in the Republic of Kazakhstan.

One of the sources of mercury in Kazakhstan, according to the inventory, is the disposal of waste in landfills. In this regard, workers involved in municipal waste collection, sorting and landfill disposal may also be at risk of exposure to mercury. However, information on the health status of this category of citizens is also lacking.

Considering the use of amalgam in dental practice as another source of human exposure to mercury, it is necessary to point out that amalgam is not used in the Republic of Kazakhstan and in this regard, this source of mercury does not pose a threat to the population.

In general, there are no sectors in the Republic of Kazakhstan where certain groups of the population are exposed to mass direct exposure to mercury. However, attention should continue to be paid to people living near historically contaminated areas (Karaganda and Pavlodar regions).

Fish consumption can be considered as one of the sources of mercury that can have a measurable impact on the population of the Republic of Kazakhstan. According to the order of the Minister of National Economy of the Republic of Kazakhstan dated 9 December 2016 № 503 «On approval of scientifically justified physiological norms of food consumption», the use of at least 11 kg of fresh and frozen fish per year is recommended. The maximum permissible concentration of mercury in the muscle tissue of fish, according to the Information Bulletin on the state of the environment of the Nura River basin, issue 3 (Q3 2011) of RSE «Kazhydromet» of the Ministry of Environment Protection of the Republic of Kazakhstan, is: non-predatory freshwater fish – 0.3 mg/kg; predatory freshwater fish – 0.6 mg/kg.

Within the framework of the GEF/UNDP project «Updating of the National Implementation Plan, Integration of Persistent Organic Pollutants Management into the National Planning and Rational Management of Medical Waste in Kazakhstan», a study of fish caught in

[11] Nezhdanova M.V. Influence of lead and mercury on the condition of kidneys in children / M.V.Nezhdanova // Russian paediatrician journal – 2004. № 4,pp19-23.

Lake Balkhash (Balkhash), River Tobol (Kostanay) and River Irtysh (Ust-Kamenogorsk) was conducted in 2016. A total of 30 specimens of 9 fish species aged 0 to 7 years were selected. The mercury content in fish tissues ranged from 0.02 to 0.52 mg/kg (average value – 0.08 mg/kg).

In the same regions, a study of mercury content in the human body was conducted. A total of 57 people were examined (1945-2009). The assessment of the results of the study was based on a standard of 1.0 mg/kg, resulting in a mercury content of 0.0118 to 1.46 mg/kg (average value – 0.293 mg/kg) in the selected material. The average level of mercury in the organism of persons consuming fish once a month was 0.274 mg/kg, once a week – 0.410 mg/kg.

Also, within the framework of the EEU Customs Union, maximum concentrations of mercury in transported goods (foodstuffs (dairy products), toys, textiles, school supplies) were established.

Thus, further in-depth study of the environment and human health will identify potential populations at risk of exposure to mercury and its consequences.

4.2 Assessing gender issues in the context of mercury management

In September 2015, Kazakhstan joined the United Nations Sustainable Development Goals, in which 12 of the 17 goals are gender-sensitive.

Today, women in society are subject to the same requirements as men in the performance of their work functions. However, in family and domestic relations, the gender stereotype of male privilege remains in place[12].

One of the most vulnerable groups to environmental risk factors is pregnant women and children.

Taking into account the list of the main sources of mercury inflow in the Republic of Kazakhstan, it is possible to single out the category of risk of mercury exposure related to professional peculiarities. For example, waste pickers at landfills are likely to be predominantly male. The same will be true for employees of mining and industrial enterprises (mining, smelting of metals, cement production).

Both men and women work in laboratories carrying out industrial environmental control, both at enterprises and state control bodies, where mercury-containing measuring devices can be used, or in those industries that are sources of mercury in the environment. More precise information on the gender composition of laboratory staff in the Republic of Kazakhstan as part of the mercury inventory was not collected.

In the case of breakage of mercury-containing household items (mercury-containing lamps, mercury thermometers), it is likely that the distribution of exposure risk will be in the hands of women, as in Kazakhstan the household is managed exclusively by women. Also, in this case, the risk group includes young children raised in families.

Addressing gender inequalities in the health effects of chemicals will empower women and help to successfully achieve sustainable development goals. The Republic of Kazakhstan is currently working to improve its legislation on the regime and protection of labour, taking into account gender aspects. The list of works prohibiting the use of female labour has been revised and women have access to types of work that do not pose a threat to women's health due to their automation, technicalization and informatization.

[12] Concept of family and gender policy of the Republic of Kazakhstan till 2030

Chapter V: Awareness/understanding of workers and the public and existing training and education opportunities of target groups and professionals

Awareness of the population of the Republic of Kazakhstan about the sources of mercury, ways of its intake and impact on the human body is insufficient. At the same time, the country has carried out activities to raise public awareness and manage mercury-containing waste.

Thus, in 2014-2017, within the framework of the GEF/UNDP project «Updating of the National Implementation Plan, Integration of Persistent Organic Pollutants Management in the National Planning Process and Rational Management of Medical Waste in Kazakhstan», the following activities were carried out in terms of raising public awareness: the 1st level of mercury inventory was carried out (the results were placed in free access), the study of mercury content in 3 pilot regions (water, soil, fish and human hair were studied), and the following activities were developed

In order to raise awareness of the serious negative consequences of mercury exposure in 2009-2013 within the framework of the project «Goal 2020 «A Future without Toxic Substances», the Green Women organization with the support of IPEN in 2015 developed a training module «Hazardous Mercury Metal: how to avoid poisoning and learn to cooperate». The module provides an overview of global experience in eliminating threats posed by mercury pollution, initiatives and research by international organizations and civil society, which have resulted in the need to develop a global international agreement on mercury – the Minamata Convention. The module also provides information on existing problems of mercury pollution, actions of governments and civil society representatives with regard to disposal of mercury-containing goods, including the situation in Kazakhstan, and recommendations of the public on the need to promote the Minamata Convention on Mercury, especially its provisions on the use of alternative mercury materials.

Local executive bodies of the Republic of Kazakhstan are making efforts to introduce separate collection of mercury-containing wastes and promote safe mercury handling. One example of such a project was the project «Beware of mercury», which was implemented in Astana in 2013-2016. The aim of the project was to teach and promote the use of special containers for collecting waste batteries, energy-saving lamps and mercury-containing lamps. In just four years, 300 containers have been installed in the city of Astana and more than 2.8 million broken bulbs have been collected, which is almost 6 kilograms of mercury.

In 2012-2017, the UNDP/GEF project «Promoting Energy Efficient Lighting in Kazakhstan» was implemented in Kazakhstan, with the main objective of transforming the Kazakh market towards energy efficient lighting technologies and gradually replacing inefficient lighting equipment to reduce greenhouse gas emissions. One of the components of the project was the development of measures to introduce a system for the collection and disposal of waste mercury-containing lamps in Kazakhstan. The project promoted separate waste collection and developed proposals on mechanisms for the collection and recycling of mercury-containing waste.

In 2018, as part of the project «Initial assessment of Kazakhstan for the Minamata Convention», seminars were held for representatives of government agencies, industrial enterprises and non-governmental organizations in terms of mercury management, the impact of mercury on the environment and public health, improving the regulatory framework for the management of mercury and mercury-containing waste, and publications were prepared in the media on the sources of mercury in Kazakhstan and its impact on the environment and the population.

Thus, attention is paid to solving problems with mercury pollution in Kazakhstan. However, the efforts of individual projects do not fully address the problem of mercury in Kazakhstan. To minimize and prevent the impact of mercury on the environment and human health, a systematic approach is required.

An important aspect of the problems of mercury pollution in Kazakhstan is the weak support for initiatives of non-governmental organizations in the field of mercury pollution. In this

case, it may be relevant to involve the most active representatives of civil society in addressing the issues of mercury and mercury waste management, as well as to work with the public to raise awareness of the impact of mercury on health and the environment. Taking into account the different levels of knowledge and interests of the public, it is recommended to organize individual materials and forms of work for each target group (teachers, schoolchildren, students, doctors, government officials, researchers, etc.). These activities should be envisaged when developing the Plan of Implementation of the Minamata Convention obligations.

Chapter VI: Implementation Plan & priorities for action

Taking into account the requirements of the current national legislation in the field of the State Planning System, for the timely implementation and implementation of legally binding requirements of the Convention, it is more expedient and effective to integrate the activities of the National Plan of obligations under the Minamata Convention into the documents of the State Planning System of the Republic of Kazakhstan.

Due to the fact that there is no approved methodology for the development of the National Plan, the rules for the development of documents of the State Planning System were taken into account in the development of the National Plan.

Target indicators:

As a result of the implemented measures the following indicators are expected to be achieved:

1. International agreements on mercury regulation ratified by the Republic of Kazakhstan – 1.
2. Inventory of mercury in the Republic of Kazakhstan – 1.
3. Expansion of the list of products (goods) that are subject to extended obligations of producers (importers) in terms of mercury and mercury-containing products.
4. The number of clinical mercury-containing thermometers included in the State Register of Medicinal Products, Medical Devices and Medical Equipment as of 2020 – 0.
5. Increase in the number of Kazhydromet RSE laboratories monitoring mercury in the environment by at least 10% by 2020 compared to 2016.
6. Availability of accredited laboratories for biomonitoring of mercury intoxication by 2020 – 1.

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National plan on reduction of use and collection of mercury

№	Activity	Basis	Due dates	Responsible body	Co-executors	Amount needed/ sources of funding	Form of completion
1.	Ratification/accession of the Republic of Kazakhstan to the Minamata Convention on Mercury	Prospective plan of international treaties conclusion	2019-2021	ME RK	MH RK MLSP RK MIID RK MNE RK MF RK MIA RK MES RK MJ RK MFA RK NCE «Atameken»	Not needed	Law of the Republic of Kazakhstan «On the accession of the RK to the Minamata Convention on Mercury»
2.	Development of a mechanism for the export/import of mercury and its incorporation into national legislation	Article 3 of the Convention	2020	ME RK	MH RK MLSP RK MIID RK MNE RK MF RK MIA RK MES RK MES RK MJ RK MFA RK NCE «Atameken»	Not needed	Project ZRK
3.	Gradual phase-out of mercury-added products containing mercury concentrations in excess of allowable values (if mercury-free alternatives are available in the Kazakhstan market); Introduction of mercury-free alternatives	Article 4 of the Convention	2022	MIID RK	ME RK MNE RK MH RK MF RK UNDP NCE «Atameken»	Not needed	Proposals for amendments to the TRs of the Customs Union, national legislation

4.	Refusal to register, re-register or amend the registration dossier of medical devices and medical equipment containing mercury in the presence of mercury-free alternatives in the Kazakhstan market	Article 4 of the Convention	2021-2022	MH RK	ME RK MNE RK MIID RK MF RK UNDP NCE «Atameken»	Not needed	Written refusal to register of mercury-containing medications and medical products
5.	Denial of type approval and metrological certification of measuring instruments containing mercury in concentrations exceeding those specified in Annex A of the Convention, if there are mercury-free alternatives on the market Kazakhstan	Article 4 of the Convention	2021-2022	MIID RK	ME RK MNE RK MF RK UNDP NCE «Atameken»	Not needed	Written refusal in type approval and metrological certification of measuring instruments
6.	Inclusion of mercury-containing products in the Single list of products subject to mandatory assessment (confirmation) of conformity within the Customs Union, approved by the Commission of the Customs Union on April 7, 2011 № 620	Article 4 of the Convention	2021-2022	MNE RK	ME RK MIID RK MF RK UNDP NCE «Atameken»	Not needed	Proposals for amendments to the Single List of Products Subject to Mandatory Conformity Assessment (Confirmation) within the Customs Union
7.	Consideration of expansion of the EMC on mercury-containing products	Article 4 of the Convention	2022-2023	ME RK	MNE RK MIID RK UNDP NCE «Atameken»	Not needed	Order ME RK
8.	Making proposals for the regulation of mercury-containing products under and CU legislation	Belarus and Russia sign Minamata Convention on Mercury	2020-2022	ME RK	MNE RK MFA RK	Not needed	Suggestions to MNE RK
9.	Establishment of a legislative and material framework for the development and	Articles 8,9 of the Convention	2020-2022	ME RK	-	Not needed	Order ME RK

	implementation of mechanisms to control mercury emissions and releases						
10.	Creation of an inventory of mercury emissions and a cadastre of releases from relevant sources or integration of these sections into Kazakhstan's existing system of state registration of sites of environmental pollution, the state inventory of production wastes and consumption	Articles 8,9 of the Convention	2022	ME RK	MNE RK MIID RK NCE «Atameken»	Not needed	Emissions and releases inventory
11.	Identification of mercury reserves	Article 10 of the Convention	Constantly	MIA RK (Committee on Emergency Situations)	ME RK	Not needed	Annual reports ME RK, MIA RK
12.	Development of measures to ensure that mercury and mercury compounds other than waste are stored temporarily in an environmentally sound manner	Article 10 of the Convention	2020-2022	ME RK	MIA RK (Committee on Emergency Situations)	Not needed	Order ME RK
13.	Development and implementation of mechanisms for the disposal of mercury wastes in an environmentally safe manner	Article 11 of the Convention	2020-2022	ME RK	-	State budget	Order ME RK
14.	Identification of mercury pollution sites	Article 12 of the Convention	Constantly	ME RK	Committee for Environmental Regulation and Control	State budget	Order ME RK
15.	Development, transfer and dissemination of modern	Article 14 of the Convention	2020-2022	ME RK	-	Not needed	Revision of Order No. 155 of the Minister of Energy of the Republic

	environmentally sound alternative technologies						of Kazakhstan dated 28 November 2014 «On Approval of the List of the Best Available Technologies»
16.	Assessing risks to human health and the environment from mercury or mercury compounds contained therein	Article 16 of the Convention	2021-2022	MH RK	-	State budget	Order MH RK
17.	Establishment of a National Focal Point for Information Exchange	Article 17 of the Convention	2020	ME RK	JSC «Zhasyl Damu»	State budget	Order ME RK
18.	Development and implementation of mechanisms to raise public and stakeholder awareness of mercury impacts and activities in the country	Article 18 of the Convention	2020-2022	ME RK	MH RK JSC «Zhasyl Damu»	Not needed	Order ME RK Order MH RK
19.	Inclusion of mercury impact studies in public procurement and scientific research programmes	Article 19 of the Convention	2020-2022	MES RK	ME RK MH RK	State budget	Order MES RK Order ME RK Order MH RK
20.	Development and implementation of interaction mechanisms with the Secretariat of the Minamata Convention.	Article 21 of the Convention	2020	ME RK	JSC «Zhasyl Damu»	Not needed	ME RK

Chapter VII: Mainstreaming of mercury priorities

Currently, environmental protection issues are included in the main strategic documents of the Republic of Kazakhstan (Table 10), but aspects of mercury management are not presented in these documents. At the same time, separate by-laws regulate the issues of export/import, production, utilization and recycling of mercury, which is reflected in Chapter 3.

Fulfilment of obligations under the Minamata Convention will require a comprehensive approach to chemicals management and is expected to require amendments and additions to the current legislation of the Republic of Kazakhstan.

Table 10 – Strategic documents of the Republic of Kazakhstan

Title of development plan / Sector plan / Sector strategy, etc.	**Time frame**	**Priority included**	**Main text included (including specific outputs, results)**
Strategic Development Plan of the Republic of Kazakhstan until 2025	2018-2025	Indication of the need to review the environmental impact assessment	Indication of the need to review the environmental impact assessment It is necessary to raise the environmental standards of Kazakhstan to the level of developed countries, including the indicators of emissions into the atmosphere by industrial enterprises and vehicles. As part of the improvement of environmental legislation, the current system of environmental impact assessment will be revised, natural resource users will be stimulated to reduce emissions, the principles of emission regulation will be improved, and progressive mechanisms of environmental regulation will be introduced.
State Programme for Infrastructure Development «Nurly Zhol» for 2015-2019	2015-2019	Indication of the need to reduce emissions into the environment and the use of environmentally friendly technologies	In the field of sustainable environmental development, development of the green economy and energy efficiency efforts will be aimed at restoring the environment, reducing emissions and discharges into the environment, the development of environmentally friendly technologies, the development of renewable energy sources, increasing their share in the energy balance
Concept for the transition of the Republic of Kazakhstan to a «green economy»	2013-2050	Indication of the need to improve existing legislation, the introduction of environmentally	o minimize the volume of industrial waste it is necessary to implement the following measures: 8) to improve legislative mechanisms of regulation of chemicals, harmonize legislation in the field of health, safety and labor protection, industrial safety,

		safe technologies.	environmental protection, including the register of chemical products, with the requirements of the Law «On the safety of chemical products»; 9) ensure the introduction of environmentally safe technologies and processes, including technologies for the destruction of wastes containing persistent organic pollutants and other hazardous wastes; 10) introduce an international system of classification and labelling of chemicals.
State Program of Healthcare Development of the Republic of Kazakhstan «Densaulyk» for 2016-2019	2016-2019	Indication of the need to reduce the impact of negative environmental factors on the health of the population	The active implementation of measures aimed at reducing the harmful effects of environmental factors on public health, including the fight against air pollution, soil and natural water reservoirs will be continued. At the same time, a map of environmental risks to public health will be developed, followed by monitoring of public health by region.

ANNEX I: List of stakeholders

The following stakeholders were consulted during project implementation:

Name	Position	Organization
Rimma Zhunusova	Advisor	Department of Multilateral Cooperation of the Ministry of Foreign Affairs of the Republic of Kazakhstan
Bekzhan Kadyrbek	Expert	Department of Economic Development of the Ministry of National Economy of the Republic of Kazakhstan
Akerke Muchtarova	Expert	Industrial Development and Industrial Safety Committee of the Ministry of Investment and Development of the Republic of Kazakhstan
Victoria Baigazina	Programme Coordinator, Sustainable Development and Urbanization Department	UNDP Kazakhstan
Viktor Muchamedzhanov	Head	Department of Ecology, Kostanay region
Daniyar Aliev	Head	Department of Ecology, Pavlodar region
Dmitry Kavrigin	Head	Department of Ecology, East Kazakhstan region
Sergey Mukashev	State Ecological Inspector	Department of Ecology, Kostanay region
Svetlana Arsentieva	Head of the Environmental Protection Department	Department of Natural Resources and Environmental Management of Kostanay region
Larisa Gimadeeva	Head of the Integrated Pollution Monitoring Laboratory	Kazhydromet branch in Karaganda region
Tatyana Kozlyanskaya	Head of the Integrated Pollution Monitoring Laboratory	Kazhydromet branch in East Kazakhstan region
Artur Akhmetov	Advisor to the Chairman of the Board	JSC «Kaustik»
Aydar Kapasov	Chairman	Public association «Human Health Institute»
Ylia Dushkina	Expert	LLP «Center for Promotion of Sustainable Development of the Republic of Kazakhstan»
Vitaly Kuzin	Director	LLP «Green Bridge»
Vadim Kushnarev	Chief Ecologist of the Ust-Kamenogorsk Metallurgical Complex's Health, Safety and Environment Service	LLP «Kazzink»

Aliya Ilyasova	International expert on gender economy	-

ANNEX II: Table for the calculation of mercury inputs to the environment [13]

C	Source category	Calculated mercury input factor	Estimated mercury yield factor, kg/year					
			Air	Water	Soil	By-products and impurities	General waste	Special processing / disposal sector
5.1	**Source category: Extraction and use of fuel/energy sources**							
5.1.1	Coal combustion in power plants	1,436	868	0	0	0	0	568
5.1.2.1	Coal combustion in industrial coal boilers	0	0	0	0	0	0	0
5.1.2.2	Other uses of coal	274	274	0	0	0	0	0
5.1.3	Oil Fuel – extraction, purification and use	487	310	81	39	39	9	9
5.1.4	Natural gas – production, processing and use	4,152	868	791	0	1,503	0	989
5.1.5	Other fossil fuels – extraction and use	106	106	0	0	0	0	0
5.1.6	Biomass power plants and heat generation	0	0	0	0	0	0	0
5.1.7	Geothermal power generation	0	0	0	0	0	0	0
5.2	**Source category: Primary (native) metal production**							
5.2.1	(Primary) mercury extraction and initial treatment	0	0	0	0	0	0	0
5.2.2	Gold (and silver) mining through the mercury amalgamation process	0	0	0	0	0	0	0
5.2.3	Zinc extraction and initial processing	42,049	27,500	505	0	0	0	14,044
5.2.4	Copper extraction and initial processing	315,087	206,067	3,781	0	0	0	105,239
5.2.5	Extraction of lead and initial processing	11,118	7,271	133	0	0	0	3,713
5.2.6	Gold mining and initial processing by methods other than mercury amalgamation	281,600	11,264	5,632	253,440	11,264	0	0
5.2.7	Aluminium extraction and initial processing	2,401	360	240	0	0	1,561	240
5.2.8	Other non-ferrous metals – mining and processing	0	0	0	0	0	0	0
5.2.9	Production of primary ferrous metal	180	171	0	0	0	0	9
5.3	**Source category: Manufacture of other metals and materials with mercury impurities**							
5.3.1	Cement production	203	81	0	0	41	0	81

[13] Calculation sheet for the «Methodology for the determination and quantification of mercury inputs to the environment», UN Environment Version 1.4, 2017

5.3.2	Production of pulp and paper	0	0	0	0	0	0	0
5.3.3	Manufacture of lime and lightweight aggregates	0	0	0	0	0	0	0
5.4	**Source category: Planned use of mercury in industrial processes**							
5.4.1	Production of chlor-alkali using mercury electrolysers	0	0	0	0	0	0	0
5.4.2	Vinyl chloride production with mercury catalyst	0	0	0	0	0	0	0
5.4.3	Acetaldehyde production with mercury catalyst	0	0	0	0	0	0	0
5.4.4	Other production of chemical elements and polymers with mercury	0	0	0	0	0	0	0
5.5	**Source category: Consumer goods with planned mercury use**							
5.5.1	Mercury thermometers	851	170	255	170	-	255	0
5.5.2	Electrical switches and relays with mercury	2,509	753	0	1,004	-	753	0
5.5.3	Mercury-containing light sources	52	3	0	0	-	49	1
5.5.4	Mercury batteries	530	133	0	133	-	265	0
5.5.5	Mercury Catalyst Polyurethane	0	0	0	0	-	0	0
5.5.6	Mercury-containing biocides and pesticides	0	0	0	0	-	0	0
5.5.7	Mercury-containing paints	0	0	0	0	-	0	0
5.5.8	Medicines for the treatment of humans and animals containing mercury	0	0	0	0	-	0	0
5.5.9	Cosmetics and related mercury-containing goods	0	0	0	0	-	0	0
5.6	**Source category: Other planned use of products/processes**							
5.6.1	Mercury for amalgam fillings	0	0	0	0	0	0	0
5.6.2	Mercury gauges and sensors	0	0	0	0	0	0	0
5.6.3	Mercury-containing laboratory chemicals and equipment	896	0	296	0	0	296	305
5.6.4	Use of mercury metal in religious rituals and folk medicine	0	0	0	0	0	0	0
5.6.5	Other uses of products, use of mercury-containing metal and other sources	0	0	0	0	0	0	0
5.7	**Source category: Production of recycled mercury («secondary» metal production)**							
5.7.1	Production of recycled mercury («secondary production»)	0	0	0	0	0	0	0

5.7.2	Production of reusable ferrous metals (cast iron and steel)	0	0	0	0	0	0	0
5.7.3	Production of other reusable metals	0	0	0	0	0	0	0
5.8	**Source category: Waste incineration*3**							
5.8.1	Incineration of municipal/common waste	0	0	0	0	0	0	0
5.8.2	Incineration of hazardous waste	1,767	1,643	0	0	0	0	124
5.8.3	Incineration of medical waste	583	543	0	0	0	0	41
5.8.4	Sewage sludge incineration	0	0	0	0	0	0	0
5.8.5	Unauthorized waste incineration	0	0	0	0	0	0	0
5.9	**Source category: Waste disposal/disposal and wastewater treatment**							
5.9.1	Controlled waste/sediment dumps*3	14,068	1,407	1,407	7,034	0	4,220	0
5.9.2	Disposal of scattered mercury with some control	0	-	-	-	-	-	-
5.9.3	Unauthorized local disposal of industrial waste	0	0	0	0	-	-	-
5.9.4	Unauthorized dumping of ordinary waste*1*3	0	0	0	0	-	-	-
5.9.5	Wastewater collection and disposal/treatment system*2	4,400	0	2,728	0	0	1,056	616
5.10	**Source category: Crematoria and cemeteries**							
5.10.1	Crematoria/cremation	0	0	0	0	-	0	0
5.10.2	Cemeteries	326	0	0	326	-	0	0
TOTAL QUANTITY OF EMISSIONS *1*2*3*4		**670,299**	**259,792**	**13,121**	**262,146**	**12,847**	**8,463**	**12, 979**

Note:
**1: Estimated quantity includes mercury in products that have also been included for each product category. To avoid double counting, landfills from unauthorized discharges of general waste were automatically subtracted from the TOTAL value.*
**2: Estimated input factor to the aquatic environment includes the amount of mercury that has already been taken into account for each source category. To avoid double counting, the ingress factors from the wastewater treatment system were automatically subtracted from the TOTAL value.*
**3: To avoid double counting of mercury inputs from waste and products at the inlet, only 10% of mercury inputs to waste incineration sources, landfill disposal and unauthorized disposal are included in the total number of mercury inputs. These 10% are approximately the same as mercury inputs from materials that have not been identified individually in Tier 1 of the inventory.*
**4: To avoid double counting of mercury in domestically produced products (including oil and gas), only a fraction of the mercury entering production is included in the total value.*