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Socio-economic assessment of POPs in Mongolia

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Summary

Mongolia has 2.796 million population, which live on 1,564,116 square kilometers area (19th in the World according to the area). The country started the transition process towards free market economy with deep recession, but the reform process and countries extensive mineral deposits and significant foreign direct investments in the mining sector leads to high growth rates in the last decade. The key indicator for quality of living, the life expectancy at birth of Mongolia is 67.3 years in 2012, which is 6 years lower than the average of the developing countries from East Asia & Pacific. The Mongolian unemployment rate is low, but 27.4 percent of population live bellows the national poverty line. In addition, only 84.6 percent of the Mongolian population has access to improved water source, and only 56.2 percent have access to improved sanitation facilities.

Health insurance coverage in Mongolia reached 98.6 percent in 2011. The social insurance in Mongolia is a socio-economic program to provide pensions, benefits or payments prescribed in the legislation to the insured person in contigencies of retirement, disability and unemployment. In total there are 334.6 thousands beneficiaries of pensions in 2012, of which 224.7 are retirement pensions and 65.8 are disabled pensions.

The key circumstances in which POPs management operates in Mongolia are: lack of POPs awareness rising activity; low level of the social responsibility of the business sector; not participatory role of the mass media; lack of expertise; lack of laboratory for POPs analysis; not existence of capacity for POPs containing waste management; limited financial resources of the country and lack of knowledge of the decision making bodies about POPs and their reluctance to allocate funds on environment issues.

The creation of a legal basis for the protection of the environment and natural recourses started in the beginning of transition process in Mongolia. Since 1994, twenty-five environmental laws passed by the Mongolian Parliament. In addition, twenty-three Environmental National Programs on protecting biological diversity, combating desertification, and protecting water and specially protected areas were approved. Mongolia has joined eleven multilateral environmental agreements so far, five of which are associated with chemicals and hazardous wastes. However, the key problem of Mongolia is the implementation of the legislation.

Three inventories of the POPs were performed in Mongolia: dioxin and furan inventory, new industrial POPs chemicals inventory and POPs pesticides inventory. The inventory of dioxin and furan estimated that a total of 114.85 g TEQ PCDD/PCDF is released in Mongolia per year and 36.0% of the total release is from medical waste incineration and 27.35% from landfills. So, 63.35% of total release is related to wastes.

The inventory of new industrial POPs chemicals finds that the country imported 47,741 tons of IT and telecommunication equipment and consumer equipment, including 15,724.6 tons of TVs and 18,287.7 tons of computers. Of the total EEEs, 3,834.5 tons was CRT monitor and 1,014.8 tones was non-CRT, which contain 7.2 tons of c-OctaBDE (CRT monitors - 7.04 tones and non-CRT - 0.192 tones). Volume of waste to be generated from the total number of CRT appliances: CRT computer monitor – 276.9 tones, containing 211 kg c-OctaBDE, and CRT television – 1,154.3 tones, containing

301.3 kg c-OctaBDE. Summing this up, a total of 12,352.3 tons of waste, containing 512.3 kg c-OctaBDE is generated in Mongolia. Content of HexaBDE in imported EEEs was 795.8 kg, in in-use EEEs 463.8 kg, in waste 56.4 kg, and content of HeptaBDE in import EEEs was 3,110.7 kg, in in-use EEEs 1,813 kg and in waste 220.3 kg. In addition, the estimated amount of total c-PentaBDE from vehicles (passenger cars, trucks and buses) is 153.3 tons.

The POPs pesticides inventory finds that Mongolia used 5983.6 liters of Hexachlorobenzene, 311.5 liters of Chlordane, 61 liters of Aldrin, 162.5 liters of Dieldrin, and 564.5 liters of Heptachlor in the period 1969 – 2003. Also, that stockpiles of 5,099 kilograms of HCH is are stored in Hovd soum of Hovd province, Jargalant soum of Tuv province, Davst soum of Uvs province, Harhorin soum of Uvurhangai, and Dundgovi provincial Veterinary, and 0,6 liters of HCB in Ugtaal and Jargalant soums of Tuv province.

POPs can enter the human body through breathing contaminated air, drinking contaminated water or eating contaminated food. In overall, 90 percent of POPs is a result of eating contaminated food, because dioxins and furans penetrate in the fatty tissue of the animals through the food chain. The human health effects of exposure to POPs could include: skin diseases; liver problems; damage the immune system, endocrine system and reproductive functions; weakening of the nervous system and developmental problems; and certain types of cancer. These health problems than affect the social wellbeing of the humans, as some combination of the following impacts: loss of income due to death in family; reduced income due to limited work capacity (influenced by illness); and medical expenses due to illness. In addition, there are socio-economic impacts on the business sector and public sector. These impacts could include, but are not limited to: loss or reduction of human capital; costs associated with health or social allowances; investments to introduce measures for prevention and control of emissions of POPs; increase of the fees for municipal waste management in order to establish sustainable integrated waste management; and cost to strengthen institutional capacities of competent authorities of municipal and regional level.

In Mongolia there are no studies that document the impact of POPs on human health, due to the lack of analytical capacity and the lack of knowledge of policy makers about the effects POPs. However, it should be expected that the problems negative POPs impacts will increase in the future if the policy makers do not undertake adequate actions.

In regard with the possible socio-economic impacts, three hot-spots were identified in the country: (i) Storage in Amgalan, Bayanzurh District; (ii) Former Transformer Maintenance Facility in Ulaanbaatar, and (iii) Main waste landfill in Ulaanbaatar. All of them are located in Ulaanbaatar - the city with highest population density in Mongolia.

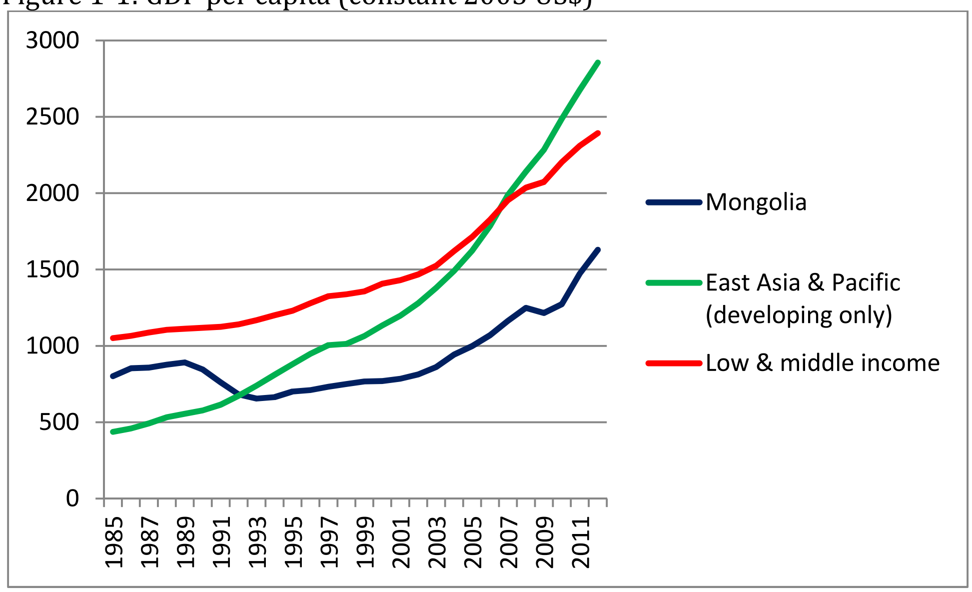
At the end, five socio-economic indicators for the monitoring and evaluation of the National-implementation plan in Mongolia are identified: Improved water source (% of population with access), Improved sanitation facilities (% of population with access), Poverty headcount ratio at national poverty line (% of population), Import of the cars older than 10 years and Progress in management of contaminated sites. The first three indicators are published by the World Bank, the last should be provided by Mongolian national statistics. These indicators could be seen as proxy of the risk of exposure of the Mongolian population on POPs.

Contents

1 Selected Indicators of Mongolian Society and Economy

The section presents some important indicators of the Mongolian society and economy. The indicators for Mongolia are presented together with the averages of the East Asia & Pacific (developing only) group of countries and Low & middle income group of countries in order comparisons to be made and country specifics to be isolated. The source of the data is the databank of the World Bank (2014). The time span is 1985-2012. In the cases where there are no available data the time span is shortened.

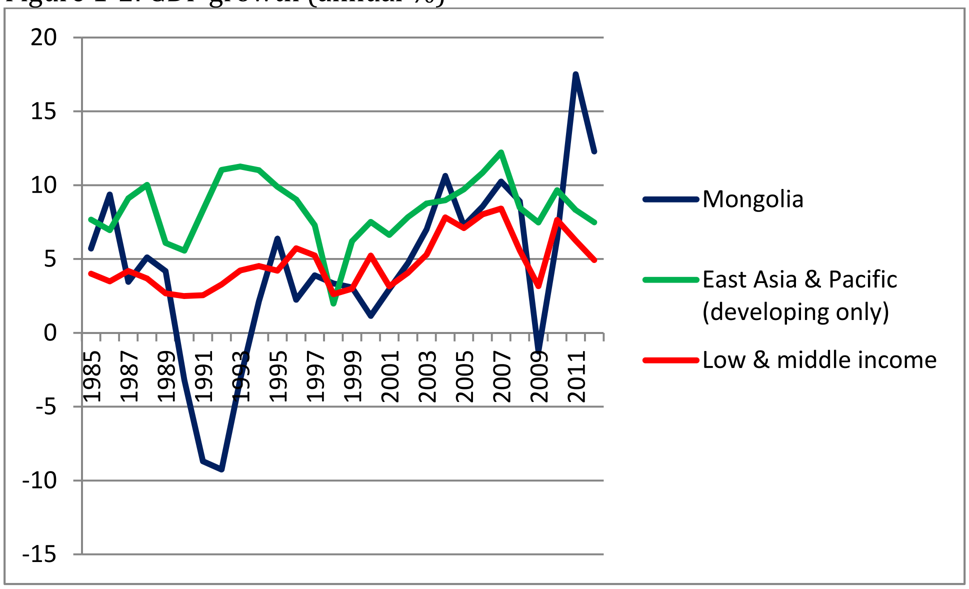
Figure 1-1: GDP per capita (constant 2005 US$)



Source: World bank (2014).

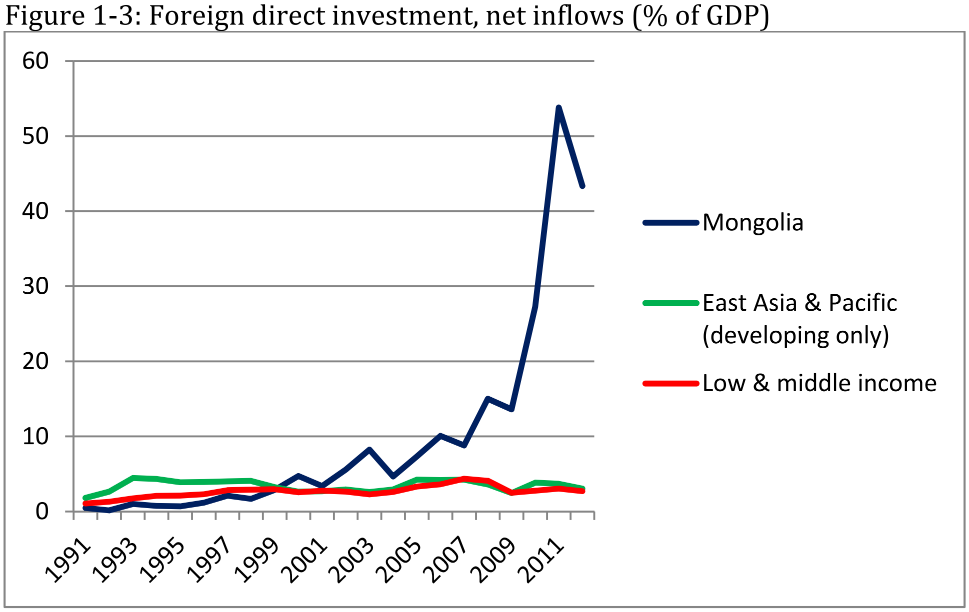
Mongolia is 19th country in the World by the size of territory. It has 1,564,116 square kilometers territory on which lives 2.796 million population. Mongolian GDP per capita is 3,673 USD in 2012. The figure 1-1 shows the development of the real GDP per capita of Mongolia and the averages of the two comparison groups. Mongolia has lower real GDP per capita than the averages of the both East Asia & Pacific (developing only) and Low & middle income countries. The GDP annual growth rate is presented in the figure 1-2. The transition process in the nineties started with deep recession, but the reform process towards free market economy leads to growth of nearly 9% per year in 2004-2008 period. Mongolia's extensive mineral deposits and attendant growth in mining-sector activities have transformed countries economy, which traditionally has been dependent on herding and agriculture. The transformation is made with significant foreign direct investments in the mining sector. Figure 1-3 indicate that Mongolia is much better in the attraction of the foreign direct investments than the East Asia & Pacific (developing only) and Low & middle income countries. The country was seriously hit by the global financial crisis, but the commodity exports to nearby countries and high government spending domestically stimulate new strong economic growth in the recent time. However, the country faces near-term economic risks from the government's loose fiscal and monetary policies, which are contributing to high inflation, and from uncertainties in foreign demand for Mongolian exports. Most important trade partner of Mongolia is China, where goes 90% of Mongolian exports, while most important energy supplier of Mongolia is Russia.

Figure 1-2: GDP growth (annual %)



Source: World bank (2014).

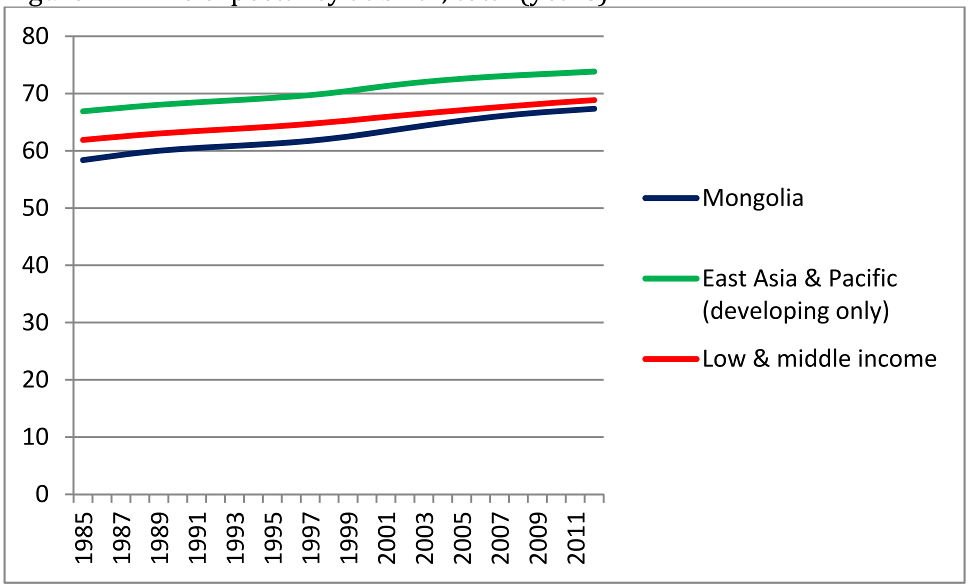
Figure 1-3: Foreign direct investment, net inflows (% of GDP)



Source: World bank (2014).

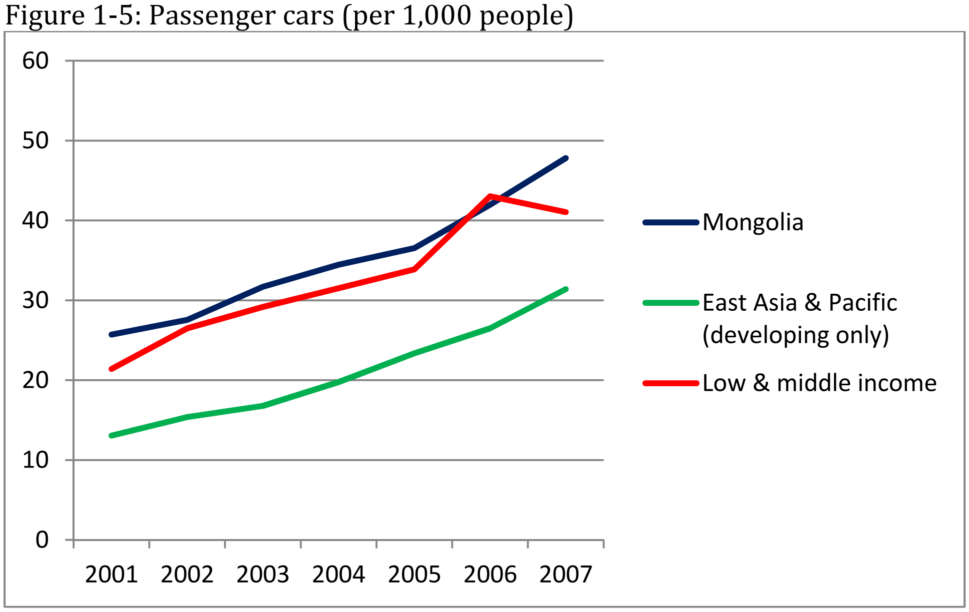
The percentage of the population who live bellow the national poverty line is 27.4 in 2012. The income inequality measured by the GINI index is increasing in the recent period from 30.27 in 1998 to 36.52 in 2008.

Figure 1-4: Life expectancy at birth, total (years)



Source: World bank (2014).

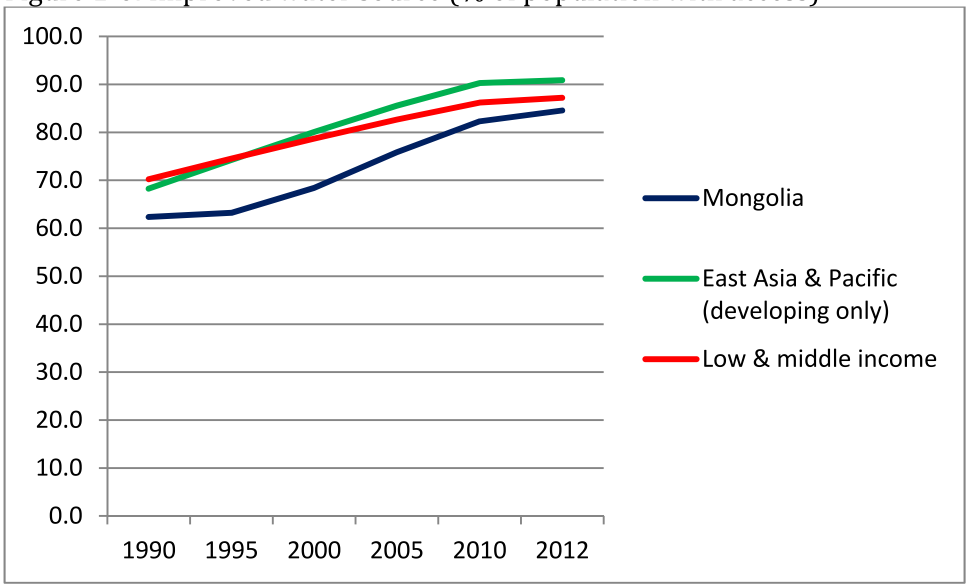
Figure 1-5: Passenger cars (per 1,000 people)



Source: World bank (2014).

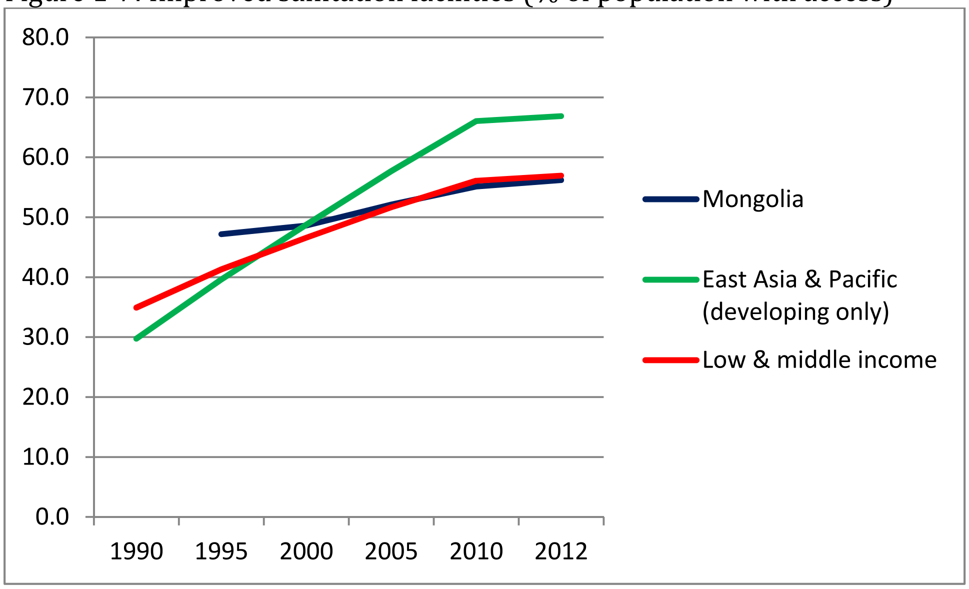
The life expectancy at birth is 67.3 years in 2012, which is lower than the average of Low & middle income (68.8 years) and the average of East Asia & Pacific (developing only) (73.8). The figure 1-4 shows that Mongolia slowly, but continually decrease the difference in this important indicator for quality of life with the both groups. It is interesting that Mongolia have more physicians per 1,000 people than both groups. In 2010: 2.8 Mongolia, 1.5 East Asia & Pacific (developing only) and 1.2 Low & middle income. The percentage of the labor force with primary education is 28 in 2011 and this percentage has sharp decline from 36 percent in 2007. The opposite is the situation with the labor force with tertiary education. It grows from 13 percent to 26 percent. In addition, the number of the passenger cars per 1000 people have strong growth trend which is similar as in the both comparison groups (figure 1-5).

Figure 1-6: Improved water source (% of population with access)



Source: World bank (2014).

Figure 1-7: Improved sanitation facilities (% of population with access)



Source: World bank (2014).

Mongolia has problems with the access of the improved water sources or improved sanitation facilities for the population. Access to an improved water source refers to the percentage of the population using an improved drinking water source. The improved drinking water source includes piped water on premises (piped household water connection located inside the user's dwelling, plot or yard), and other improved drinking water sources (public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs, and rainwater collection). Access to improved sanitation facilities refers to the percentage of the population using improved sanitation facilities. The improved sanitation facilities include flush/pour flush (to piped sewer system, etc.). Only 84.6 percent of the Mongolian population have access to improved water source, while only 56.2 percent have access to improved sanitation facilities. However, figures 1-6 and 1-7 indicate that there are trends of improvement of the access in both cases.

2 Sociological, technological, economical and political environment in which POPs management operates

The section presents the results of the stakeholders brainstorming session regarding sociological, technological, economical and political (STEP) circumstances in which POPs management operates in Mongolia. The session was performed at the "National objective section and objective setting workshop", on 22.4.2014 in Ulaanbaatar.

Table 1-1: STEP environment of the POPs management in Mongolia

Sociological - Poor knowledge of population about POPs containing products and wastes; - Poor knowledge of population regarding the effects of POPs is low; - Lack of POPs awareness rising activity; - Social responsibility of the business people is low; - Mass media is likely to make sensations about unconfirmed information about chemical hazards;	**Technological** - Lack of laboratory for analysis of POPs; - Not existence of capacity for POPs containing waste management; - Lack of expertise;
Economical - State budget is limited; - POPs management activities are expensive;	**Political** - Lack of knowledge of the decision making bodies about POPs; - Decision makers are reluctant to allocate funds on environment issues.

Source: Stakeholders brainstorming session using STEP tool, Workshop in Ulaanbaatar (22.4.2014).

The results of the session are provided in the table 1. Regarding sociological circumstances of POPs management, the stakeholders pointed out the poor knowledge of the population regarding POPs containing products and wastes, as well as not awareness of population of the POPs effects. They identify three important issues for this situation: lack of POPs awareness rising activity, low level of the social responsibility of the business sector and not participatory role of the mass media.

Regarding technological circumstances, they identified the lack of expertise, the lack of laboratory for POPs analysis and not existence of capacity for POPs containing waste management, as the most important issues. Regarding economical circumstances, the stakeholders stressed the dualism between the limited financial resources of the country and the expensive activities of the POPs management. Regarding political circumstances of POPs management, the stakeholders pointed out the lack of knowledge of the decision making bodies about POPs and their reluctance to allocate funds on environment issues.

3 Mongolian legislation related to POPs

This section reviews existing documents related to management of POPs chemicals in Mongolia. The source of information presented in this section is the Legal Assessment of POPs in Mongolia, prepared by the National Project Team.

The creation of a legal basis for the protection and rehabilitation of the environment and natural recourses started in the beginning of transition process in Mongolia. Since 1994, the package of twenty-five environmental laws passed by the Mongolian Parliament (State Great Hural). In addition, twenty-three Environmental National Programs on protecting biological diversity, combating desertification, and protecting water and specially protected areas were approved. Mongolia has joined eleven multilateral environmental agreements so far, five of which are associated with chemicals and hazardous wastes, namely:

- The Vienna Convention on Ozone Layer Protection (1996);
- The Montreal Protocol on Ozone Layer Depleting Substances (1996);
- The Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal (1997);
- The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (2000); and
- The Stockholm Convention on Persistent Organic Pollutants (2004).

The general environmental laws include the Law on Environmental Protection and the Law on Environmental Impact Assessments. Both of these laws are intended to have general applicability and set environmental protection standards. The Law on the Environmental Protection of Mongolia (LEPM) is the umbrella law for all environmental and natural resource laws. LEPM was adopted by the State Great Hural in March of 1995, and became effective in June of the same year.

The most important law in relation to POPs chemicals is the Law on Toxic and Hazardous Chemicals. The first version of this law was introduced in 1995 as the result of serious waste disposal problems. Until the approval of this law, there was no specific law regulating toxic chemicals or hazardous wastes. The new version of this law was adopted on 25 May 2006. It regulates the production, export, import, storage, trade, transport, use and disposal of toxic chemicals. In comparison with the first version, it strengthens the control over chemical substances, with special emphasis on their import. However, this law covers not only toxic and hazardous chemicals, but all the chemical substances, including pesticides and household or consumer chemicals. It is divided into three charters covering general provisions, requirements for protection and administrative penalties. As provided by this law, chemicals shall be imported only through a few designated border ports and strict control and monitoring will be started from this point. In addition, classification of chemicals will be done in accordance with international standards. Risk assessment issues also reflected in the law.

The Government of Mongolia approved the following programs to protect the environment and human welfare, reduce the environmental pollution, and improve the management on chemical substances and waste:

1. Program of sustainable development in XXI century of Mongolia (1998) (Chapter20 - Ecological Management on toxic chemical substances; and Chapter21 - Management on waste);
2. Program of reducing wastes;
3. National program of protecting ozone layer (1999);
4. National program of environmental health (2005);
5. National program of Persistent organic pollutants (2006);

The following standards are used:

1. Air quality: General technical requirements (MNS 4585: 2007) (Note: POPs not included)
2. Acceptable concentration of air pollutant elements: General technical requirements (MNS 5885: 2008);
3. Soil quality: Soil pollutants elements and substance (MNS 5850: 2008);
4. Water quality: Water pollutants elements and substance (MNS 6148: 2010);
5. Drinking water: Hygienically requirements, assessment of the quality and safety (MNS 900: 2011);
6. Air quality: Permissible air emission level for dioxin and furans (MNS 6342: 2012);
7. Insulating liquids: Contamination by PCBs and Method of determination by capillary column gas chromatography (MNS CEI EN 61619: 2011).

3.1 Mongolian regulation of the provisions of the Stockholm Convention on Persistent Organic Pollutants

The following Mongolian normative acts are related with Stockholm Convention on Persistent Organic Pollutants:

Production and use of the chemicals listed in Annex A of the Stockholm *Convention (aldrin, chlordane, dieldrin, hexachlorobenzen, mirex, heptachlor, toxaphene and PCB)*

- **The Law on Toxic and Hazardous Chemicals (article 5, paragraph 1)**
  Permissions for production, trade and use of toxic and hazardous chemicals shall be issued under the Law on Licenses for Economic Activities.
- **Decree No 75 of the Minister of Nature and Environment of 1997.**
  Use of Aldrin, Chlordane, Dieldrin, Endrin, Heptachlor, Toxaphene and DDT was banned.
- **Government Resolution No 95 of 2007**
  Use of Hexabromodiphenyl ether and heptabromodiphenyl ether, Chlordecone, Tetrabromodiphenyl ether and pentabromodiphenyl ether (commercial

pentabromodiphenyl ether), Perfluorooctanesulfonic acid perfluorooctane sulfonate, Pentachlorobenzene, endosulfin was banned.

- **Regulations on the PCB inventory and labeling, collection, transportation, storage and disposal, import, export, cross-border transportation: Annex of Joint Decree of the Minister of Environment, Nature and Tourism And the Minister of Health A-17/16**.
  8. Decontamination and disposal of PCBs; 8.1. Licensed business entities, authorized from the state central administrative body in charge of nature and environment, manage to decontaminate and dispose waste containing PCBs; 8.2. The methods for PCB elimination and waste containing PCBs could be accepted only if they meet the standards of environment safety, as well as the technical demands as most available techniques; 8.3. The content of PCBs in the transformer oil is reduced to a concentration of less than 50ppm, and if possible, less than 20ppm: 8.4. Oil can be replaced by the PCB free oil; 8.5. Upon decontamination, the label on the equipment should be replaced with the label defined in Annex 1D; 8.6. The holder of the decontaminated equipment /transformer/ should additionally test the PCB concentration in the liquid by the accredited laboratory after six-month operation of the equipment, starting with the decontamination date. If it is determined that upon the additional testing the PCB level in the equipment is more than 50ppm, the decontamination procedure should be repeated; 8.7. Equipment and waste containing PCBs in the concentration of 50ppm should be decontaminated or disposed by December 31, 2019.

Import and export of the chemicals listed in Annex A of the Stockholm *Convention*

- **The Law on Toxic and Hazardous Chemicals (article 5, paragraph 1)**
  Permissions for export, import of toxic and hazardous chemicals shall be issued under the Law on Licenses for Economic Activities.
- **Regulation on export, import, cross-border transport, production and trade of toxic and hazardous chemicals**
  Permission of export, import and cross-border transportation of toxic and hazardous chemicals shall be issued under the central government organization responsible for nature and environment.
- **Regulations on the PCB inventory and labeling, collection, transportation, storage and disposal, import, export, cross-border transportation: Annex of Joint Decree of the Minister of Environment, Nature and Tourism and the Minister of Health A-17/16**
  9. PCBs import, export, cross-border transport; 9.1. Citizens, business entities are prohibited following activities; 9.1.1. Import or cross-border transport equipment or products containing PCBs in a concentration of 2mg/kg or more; 9.1.2. Import equipment or lubricant materials without PCBs concentration analysis; 9.2. Result of the accredited laboratory analysis is needed to import oil, lubricant materials and equipment containing oil; 9.3. Importer is responsible for all expenditure of disposal and decontamination of equipment and products containing PCBs in a concentration of 2 mg/kg or more to import; 9.4. The central State administrative body in charge of nature and environment issue licenses with the following requirements to export waste containing PCBs based on the

result of the accredited laboratory; Import of waste containing PCBs is legal for the importer country; Agreement with authorized business entities to decontaminate and dispose waste containing PCBs by environmentally sound manner; 9.5. Citizens, business entities should apply the request in a written form for exporting waste containing PCBs and following documents needed to; 9.5.1. Agreement with importer to import wastes containing PCBs; 9.5.2. Importer's license of importing wastes containing PCBs.

Restricted production and use of the chemicals listed in Annex B (DDT) of the Stockholm Convention

- **The Law on Toxic and Hazardous Chemicals (article 5, paragraph 1)**
  Permissions for production, trade and use of toxic and hazardous chemicals shall be issued under the Law on Licenses for Economic Activities.
- **Regulation on export, import, cross-border transport, production and trade of toxic and hazardous chemicals**
  Permission on production of toxic and hazardous chemicals shall be taken from the the central government organization responsible for nature and environment after appropriate conclusions made by relevant organizations based on the risk assessment with a "report of detailed environmental impact assessment".

Measures to ensure that a chemicals listed in Annex A or Annex B is imported only with the purpose of: (i) Sound disposal as set forth in paragraph 1 (d) of Article 6; or (ii) Use application for purposes permitted under Annex A of Annex B.

- **Law on Waste (article 17, paragraph 1)**
  Prohibits to import hazardous wastes into Mongolia for the purpose of usage, storage, temporary placement and disposal.
- **Law on Waste (article 17, paragraph 2)**
  Prohibits to transiting hazardous wastes through Mongolian territory.
- **Law on Waste (article 15, paragraph 1)**
  An permission for export of hazardous wastes shall be taken from the state central organ in charge of environment, basing on the decisions and conclusions made by specialized institutions.

Export of chemicals substances listed in Annex A or Annex B of the Stockholm Convention

- **Registering and testing regulation of pesticides in Mongolia** (approved by the joint ordination of Minister of Nature and Environment, Minister of Industry and Agriculture, Minister of Health and social security, 86A164, 1999).

Minimization of environmental releases of substances used under the regulations, excluding them from the rules of the present Convention

- **Regulations on the PCB inventory and labeling, collection, transportation, storage and disposal, import, export, cross-border transportation: Annex of Joint Decree of the Minister of Environment, Nature and Tourism and the Minister of Health A-17/16**

11. Prohibited activities; 11.1. No release PCBs in the following concentrations into environment: 2 mg/kg or more for a liquid containing PCBs and 50mg/kg or more for a solid containing PCBs; 11.2. Citizens, business entities are prohibited to remove PCBs from the equipment to re-use; 11.3. Oil and wastes containing PCBs are prohibited to use except referred to 6.1, 6.2 of this regulation.

Measures to reduce or eliminate releases from the unintentional production.

- **Environmental protection law (article 31, paragraph 6).**
  - to keep records on toxic substances, adverse impacts and wastes discharged into the environment while engaged in production or services and to write reports and collect data on the measures taken to reduce or eliminate toxic chemicals, adverse impacts and wastes, as well as on any monitoring equipment and its operation and to submit these to the relevant organisation on time.
  - companies and organizations involved in production and servicing with quality of certain hazards and impacts to the environment shall indicate a fund in their annual budget expenses required for restoring damaged lands, contaminated soils and polluted waters and reproduction of fauna and flora;
- **Law on Air (article 10, paragraph 3)**
  - in case if emissions from companies and industries to air and their physical toxicity is proved to be detected that the emissions and impacts are exceeded the standard limit, to halt or temporarily close activities of the company or industry until the violation and impacts eradicated.
  - if repeated violations by companies and industries are obsrved, violating companies shall be shut down or in some cases the production shall be changed to another production.
  -.prohibits to contaminate, open disposal and burning of hazardous and unpleasent odor substances and wastes in urban and settled areas.
- **Law on Air (article 13, paragraph 3).**
  - when using physically harmful impacts and high emission resources in the production, individuals, companies and organizations shall equip their production facilities with controlling devices for monitoring every emission and pollution resources, as well as with impacts-reducing equipment.
  - corresponding state central organ, Governors of settlements and districts and environmental inspectors shall control the implementation of obligations in the above paragraph and the exploitation condition of the devices and equipement.
- **Law on water (article 13, paragraph 2)**
  - Any activities of production, service or property units with water use technology not consistent with international or national standards shall be prohibited.
- **Law on water (article 15, paragraph 1)**
  -It is prohibited to discard wastes, garbage or polluting substances into and around water sources, riverbeds, channels, dry ravines, and in protected zones.
- **Law on land (article 50, paragraph 6)**
  - to take measures at their expense to preserve land characteristics and quality,

to prevent deterioration of soil fertility, deterioration of vegetation cover, soil erosion, degradation, soil becoming arid, marshy, soil salinization, its pollution and poisoning (chemical pollution) due to natural causes and human factors

Measures to reduce or eliminate releases from stockpiles and wastes

- **Law on Waste (article 6, paragraph 1) (It is in preparation – it is not approved yet)**
  The Government will approve a regulation on permission for citizen and economic entities engaged in collection, package, temporary placement, transportation, disposal, recycling and storage of hazardous waste .

Cooperation with the Basel Convention bodies in the matter of control of trans-border movement of hazardous, POP-containing waste

- **Mongolia has ratified the Basel Convention in 1997.**

Development of a plan for implementation of obligations under the Convention and control of its execution

- **The Government approved the NIP on POPs by the Government Resolution No99 in 2006.**

The responsibilities in the respect of information exchange between the Parties via Secretariat of the Convention

- **Law on Toxic and Hazardous Chemicals**
  - 6.1.10 share information on toxic and hazardous chemicals with international organizations and provide the public with information on physical and chemical properties, toxicity and hazards of such chemicals, measures to be taken in the event of accidents and risks involving such chemicals, methods of destruction and transport of such chemicals and their mixtures and waste;
  - 6.1.11 within its delegated authority, implement the international treaties on toxic and hazardous chemicals to which Mongolia is a signatory;

Public information and education of society

- **Environmental protection law (Article 36, paragraph 7)**
  - 1. The Government shall adopt and organize the implementation of a programme of ecological training and education and the development of environmental protection methods and skills within the framework of formal and informal educational systems.
  - 2. Activities on ecological training and education shall be organised in the following ways: 1) the teaching of basic courses and skills on environmental protection at pre-school education institutions and secondary schools; 2) the teaching of scientific and legal courses on environmental protection and proper use of natural resources at colleges, universities, institutes and vocational training schools, taking account of their professional orientation; 3) the publication in the mass media of ecological education, traditions and customs related to environmental protection and environmental legislation.

Research, development and monitoring

- **Environmental protection law (Article 10 – Environmental monitoring)**
  The monitoring network shall conduct the following activities: to regularly conduct surveys on the level of physical, chemical, and biological changes to the environment and of pollution, and to establish and assess the extent of environmental changes;
- **Environmental protection law (Article 10 – Environmental research and funding)**
  1. Research to establish the potential for State and regional development, the restoration, breeding and raising of endangered animals and plants, protection of soil, water, and air, and for humans to live in a healthy and safe environment shall be funded by State and local budgets
  2. The central State administrative body and relevant Governors shall request the appropriate certified organisations to conduct environmental research, and develop proposals and shall fund this by means of the Science and Technology Fund and relevant budgets, and shall encourage interested citizens, business entities, and organisations to conduct research at their own expense.

Reporting: the duty of submitting the reports on activities, statistical data concerning production, export and import

- **Law on Toxic and Hazardous Chemicals**
  - 6.1.10 share information on toxic and hazardous chemicals with international organizations and provide the public with information on physical and chemical properties, toxicity and hazards of such chemicals, measures to be taken in the event of accidents and risks involving such chemicals, methods of destruction and transport of such chemicals and their mixtures and waste;
  - 6.1.11 within its delegated authority, implement the international treaties on toxic and hazardous chemicals to which Mongolia is a signatory.

4. Health-care and social protection systems

This section is consisted of two parts. The first part presents the Mongolian health-care system, while the second provide an overview of Mongolian social insurance and welfare.

4.1 Health-care system

The source of information for this subsection is State Implementing Agency of Health, Government of Mongolia (2012).

The health sector of Mongolia comprises of public, private and mixed ownership health organizations that provide public health, medical, pharmaceutical, and other health services, carry out research and training activities. Health care is provided by family health centers, soum and village health centers, inter-soum hospitals, clinics, maternity centers, public health centers, general hospitals, sanatorium, ambulance service center, regional diagnostic and treatment centers central hospitals and specialized centers (Note: Administratively, Mongolia is divided into capital city and aimags. Aimags are further divided into soums and soums into baghs. The capital city is divided into districts and districts are divided into khoroos). The table 4-1 presents the health care organizations in the country by the level of care in 2011.

Family health centers are private health organizations where general practitioners come together on their free will to do group medical and health practice. Provision of basic health services to urban population is contracted out to family health centers. Since 2002 the urban population becomes fully covered by the family group practices (FGP). In 2011, there were 219 FGPs. 124 FGPs provide primary medical care and public health services to 1265.7 thousand residents of Ulaanbaatar and 95 serve 590.4 thousands residents of 21 aimag centers. In total 2235 health workers work in FGPs of which 785 are doctors and 756 are nurses. In 2011, 5.9 million outpatient visits were made to FGPs which means on average a person made 3.2 visits per year. Proportion of preventive examinations among the total visits was 42.0% for FGPs operating in Ulaanbaatar and 31.8 percent for FGPs located in aimag centers.

Table 4-1: Health care organizations in Mongolia by the level of care, 2011

Health care provider	Number
Family health centers	219
Soum health centers	274/19
Intersoum hospitals	37
District hospitals	12
Rural general hospitals	6
Aimag general hospitals	17
Regional Diagnostic and Treatment centers	4
Central Hospital and Specialized Services	16
Maternity hospitals	3
Other hospitals	47
Private hospitals with beds	171
Private hospitals for outpatients	1013
Hot spring	67
Drug supply companies	158
Drug manufactures	42
Drug stores	703
Other	119
Total	*2927*

Source: State Implementing Agency of Health, Government of Mongolia (2012).

Soum and village health centers provide health services to their catchment population and depending on the total number of population and geographical location they can have branch. Most soum and village health centers deliver both modern and traditional medical services. Inter-soum hospitals serve to population of the soum where it is located as well as to population of neighboring soums. According to “Soum Hospital Organizational and Operational Standard” approved in 2001, soum health centers are divided into three categories depending on the size of their catchment population. The first category includes soum health centers which deliver health care and services for 4,500 and above residents and should have at least 7 doctors. The second category includes soum health centers which cover between 3,001 and 4,500 people and have a minimum of three physicians. Finally, the third category includes soum health centers which deliver health care and services to a population of up to 3,000 people and must have at least 1 doctor. The table 4-2 presents selected soum health center and inter-soum hospital quality and accessibility indicators.

According to newly enacted Health Law of Mongolia general hospital is a health organization which provides out and in patient medical services by at least 7 specializations (internal medicine, pediatrics, obstetrics and gynecology, general surgery, dental care, neurology and infectious disease). Depending on the population health needs and demand a general hospital may have affi liated outpatient clinic within catchment area. Aimag and district public health centers are entitled to implement public health policies, programs and related legislative regulatory documents, and organize activities to promote health and create environment that support population health at aimag and district levels. In 2011, 903 physicians, 1515 nurses, 2108 other allied medical personnel are employed by 17 aimag general hospitals. Total number of staff in all aimag general hospitals is 4471. Out of 2637 health personnel working in 8 district general hospitals 711 are physicians, 766 are nurse and 1027 are allied health professionals. Aimag general hospital beds account for 16.9% of total hospitals beds and in 2011 number of beds reached 3213. District general hospital beds account for 9.5% of total hospital beds and district general hospitals admitted 76.7 thousand patients.

Table 4-2: Selected soum health center and inter-soum hospital quality and accessibility indicators, 2011

Indicator	Soum hospital	Inter-soum hospital	Total
Number of hospital beds	2928	675	3603
Number of physicians	576	171	747
Number of nurses	1341	243	1584
Average length of stay	8.0	7.8	7.9
Number of in-patients	109,720	22,905	132,625
Number of out-patients	2,009,293	427,516	2,436,809
Percentage of preventive medical check-up	39.5	37.5	39.2
Maternal mortality ratio per 100,000 live births	58.0	145.3	76.4
Infant mortality ratio per 1,000 live births	36.2	28.3	34.5

Source: State Implementing Agency of Health, Government of Mongolia (2012).

Regional diagnostic and treatment center (RDTC) is a health organization main responsibilities of which include delivering medical services to the population in the region, provision of professional support to other health organizations, carrying out research and training activities. There are 4 RDTCs in Orkhon, Dornod, Uvurkhangai and Khovd aimags.

Central hospital is health organization which delivers out and inpatient specialized medical services to patients referred from other hospitals, provides professional support to other health organizations, carries out extensive research and training activities. Specialized centers are health organizations that provide medical services specialized in a particular field of medicine to out and inpatients referred from other health organizations, professional support to other health organizations, carries out extensive research and training activities. Hospital beds in central hospital and specialized centers account for 21.1% of total hospitals beds and 19.8% of inpatient were admitted to these hospitals and centers.

In 2011, 1013 private clinics and 171 private hospitals were registered 1677 physicians and 1135 nurses provide professional care in these hospitals and clinics. In total private hospitals and clinics have 4842 staff.

In 2011 number of private hospital beds reached 3069 which account for 16.2% of the total hospital beds. The number was 1982 in 2005. Starting from 2005, health sector has taken a policy to restrict establishment of new private health organizations especially those with beds, while supporting existing hospitals by contracting out some of the public hospital services. In 2005, total of 1,016,705 outpatients visited the private clinics and hospitals and 63,267 patients were admitted to the private hospitals. These numbers increased reaching 1,986,901 for outpatient visits and 97,821 for hospitals admissions in 2011.

Health expenditure was 3.3 percent of GDP in 2011. The composition of its funding was: 76.0% of by state budget, 20.9% was funded by Health Insurance Fund and 3.0% was funded by fee-for service and other incomes.

Health insurance

Health insurance in Mongolia coverage reached 98.6 percent in 2011. In the same year, the total revenue of the Health Insurance Fund was 121.6 billon tugrik, where 43.9 percent of total health insurance revenue was collected from employers, 42,9 percent paid by insurees, 9.0% paid from state budget as premium of those whose health insurance is paid by the Government according to the Law and 4.2% was collected from other sources. Health insurance expenditure was 89.9 billion tugrik, where 79.0% of health insurance fund expenditure was reimbursement of services provided by public health organizations. The share of reimbursement transferred to private health organizations has been increasing reaching 21.0% in 2011.

4.2 Social protection system

The source of information for this subsection is National Statistical Office of Mongolia (2013).

The social insurance in Mongolia is a socio-economic program to provide pensions, benefits or payments prescribed in the legislation to the insured person in contigencies of retirement, disability and unemployment. Social Insurance Fund comprised of contribution revenue collected from employers, insured persons salaries, and other sources with the purpose of financing payment of pensions, benefits, and services and opertational expences of the social insurance organization.

The expenditures of the Mongolian social insurance system in 2012 are provided in the table 4-3. The pensions are montly payments from Social Insurance Fund with the purpose of providing social security for elderly persons during their pension age, disabled persons until their recovery or up to their pensionable age and deceased insured’s survivors (child up to age 16, if he or she studies up to age 19). In total there are 334.6 thousands beneficiaries of pensions in 2012, of which 224.7 are retirement pensions and 65.8 are disabled pensions.

Table 4-3: Expenditures of Social Insurance Fund, by types

Welfare service	Amount in millions tugrik
Pensions	65,615
Allowances and benefits	125,162
Services and concessions	20,108

Source: National Statistical Office of Mongolia (2013).

Allowances and benefits are one-off payment of a lump sum made by the Social Insurance Fund to insured persons in a form of loss of working ability, maternity and child care benfit. In addition, there are different types of conditional cash benefits and services and concessions to persons in need, as elders, people carying elders and disabled people. Also, starting from October 2012, 20 thousand tugrik (11 USD) are given to the children with age of 0-18 every month.

5 The key findings of POPS inventories in Mongolia

This section presents the key findings of the three POPs inventories in Mongolia.

5.1 Dioxin and Furans

The source of information is the report: Dioxin and furan inventory (2013), prepared by the Dr. B. Avid, Scientific researcher of the Academy of Science.

5.1.1 Important remarks regarding dioxin and furans in Mongolia

The most important sources of dioxin and furans releases in Mongolia are: waste incineration, open burning, disposal/landfill, fuel incineration and production of chemical and consumer goods.

In Mongolia, incinerators do not exist, except for medical wastes. The medical wastes are processed in specifically designed incinerators, which are used in most of provinces and are basically hand-made and simple in design and do not have APCS installed. Approximately, 956 tons of medical waste is incinerated per annum. Most of the PCDD/PCDFs emission, which belongs to this Category, is released to air.

The forest and steppe fires and burning of waste are common practices in Mongolia. In 2012, registered fire cases covered 32,600 hectares of forest and 117,500 hectares of grassland. In addition, annually, 1,500,000 tons of waste is generated and it is assumed that 10% is burned.

There are three landfills in the capital city of Ulaanbaatar, which have non-thermal waste disposal processes. The estimated amount of yearly waste transported to the three landfills is between 730,000-840,000 tons, where it is buried by landfill technology. About 30% of the municipal waste is recyclable i.e. papers, plastic containers, cans and bottles. In 2010, 25,800 tons of waste or 7.6% of total waste generated was exported as a secondary raw material. There is no system for waste segregation.

The heat and power generators, as well as boilers and household stoves are considered as significant sources of PCDD/PCDFs emissions. There are 3,134 heat and power generators in the country, including 255 in Ulaanbaatar. The heat and power generators in Ulaanbaatar used 4,454,596 tons of coal, oil and diesel. These household stoves usually burn coal and firewood. The number of stoves up to 100kWt capacity is 489,257 pieces nationwide.

In the production of chemicals and consumer goods some forms of chlorine is used to some extent and it is possible PCDD/PCDF formation to takes place and potentially be released. In Mongolia, wool, cashmere and leather productions are included in this group. Before 2009, industry purchased about 4,000 tons of wool for their production. Recent years, wool production has been increasing 2-3 times thanks to economic incentives by the Government for wool production by herders (2,000 Tugriks per kilogram of sheep or camel wool prepared).

5.1.2 Results of the new industrial POPs inventory

Inventory of sources of PCDDs and PCDFs in Mongolia was conducted in the 2012, using the "Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases", Geneva, 2003, 1st edition, developed by UNEP. The preliminary inventory of potential dioxin and furan releases in Mongolia was done in 2005.

Inventory was prepared, basing on the data from local officers in charge of chemicals and 2012 National Statistics. It is estimated that a total of 114.85 g TEQ PCDD/PCDF is released in Mongolia per year and 36.0% of the toal release is from medical waste incineration and 27.35% from landfills. In other words, 63.35% of total release is related to wastes. For other source groups, open burning – 11 .1%, heat and power generation – 9.94%, ferrous and non-ferrous metal production, as well as production of mineral products – about 2-4%, respectively. For the release routes, about 57% released to air, 32% in residues and about 10% with products.

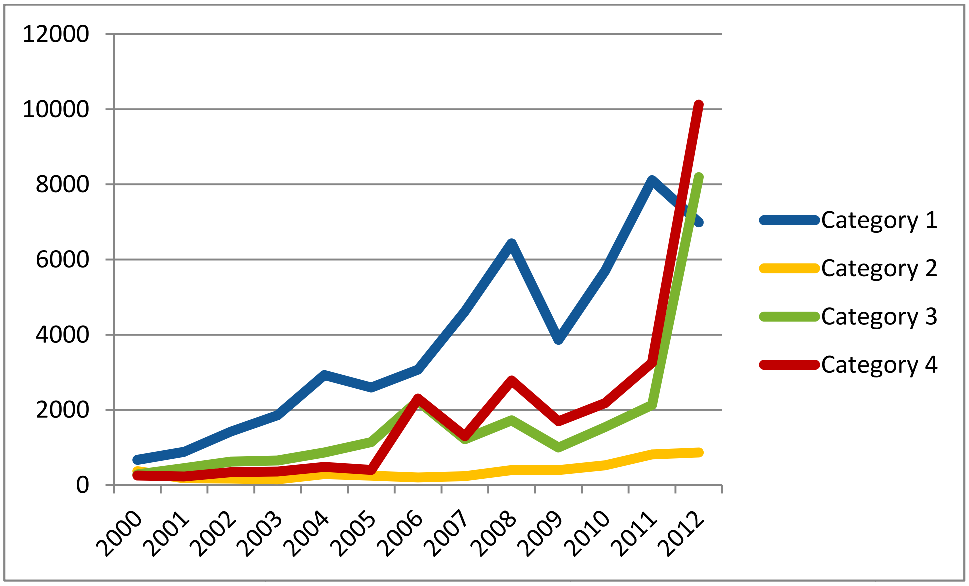
5.2 New industrial POPs in Mongolia

The source of information is the report: New POPs – report of industrial POPs chemicals inventory (prepared by the Dr. B.Bayarmaa , Institute of Chemistry and Chemical Technology, Mongolian Academy of Science).

5.2.1 Important remarks regarding new industrial POPs in Mongolia

Regarding **Electrical and Electronic Equipment (EEE)**, Mongolia imported EEE solely from the former Soviet Union until 1990s. The volume of EEE import and its composition increased dramatically as the country shifted to the free market economy, and the EEEs have been imported mainly from Asian manufacturers (China, Republic of Korea, Japan, Malaysia, Taiwan etc.). The figure 5-1 presents the dynamics of EEEs import (in tons) in Mongolia in the period 2000-2012. The lines present different categories of EEEs: large household appliances (category 1), small household appliances (category 2), IT and telecommunication equipment (category 3) and consumer equipment (category 4). The import of large household appliances (category 1) increased from 668 tons in 2000 to 6988 tons in 2012. The import of small household appliances (category 2) increased from 367 tons in 2000 to 865 tons in 2012. The import of IT and telecommunication equipment (category 3) increased from 283 tons in 2000 to 8194 tons in 2012. The import of consumer equipment (category 4) increased from 251 tons in 2000 to 10122 tons in 2012.

Figure 5-1: EEEs import (in tons) in Mongolia in the period 2000-2012



Source: New POPs – report of industrial POPs chemicals inventory.

In addition, considerable amount of used (second-hand) EEEs had been brought to the country from developed countries as foreign aid since the 1990s, but this has been reduced significantly in recent years. Also, companies that bring EEE parts and accessories to the country to assemble final products have been emerging.

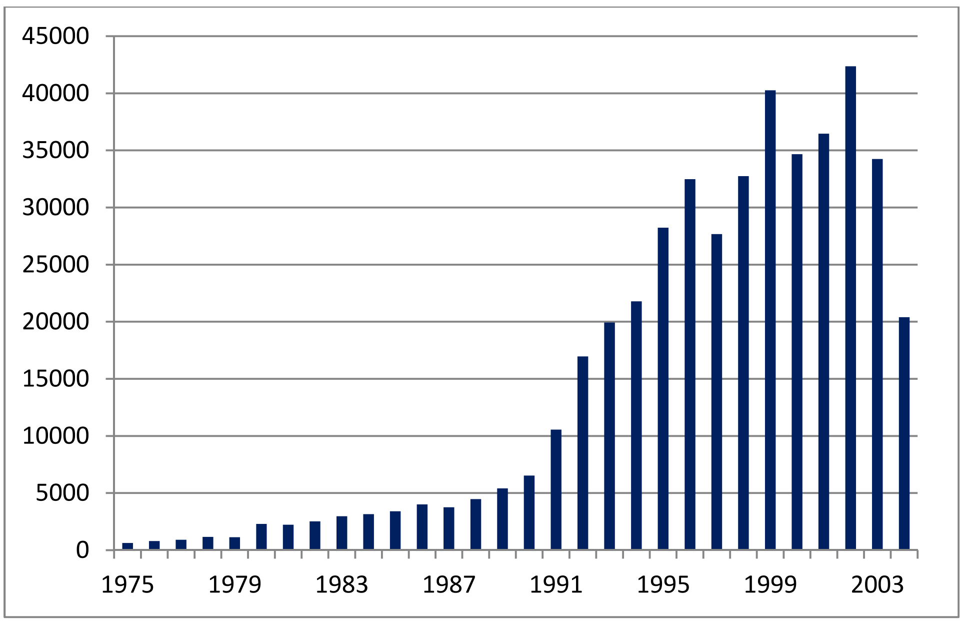
Figure 5-2: Illustration of storage places of EEEs

Source: Presentation of Dr. B.Bayarmaa at the Workshop held on 22-4-2014 in Ulaanbaatar.

In contradiction of the growing volume of EEE import and use, no waste EEE collection, separation and recycling system is in place yet and it was impossible to calculate the volume of waste of EEE produced in the country. Consumers usually get rid of their used EEEs in a way to donate to others or sell as spare parts, or just dispose of it together with household wastes. Due to the lack of disposal facility, large stock of used EEEs or EEEs waste had been accumulated in government agencies. Figure 5-2 presents storage places of EEEs. Mongolia has never produced PBDEs.

Regarding **transport sector**, the total number of registered vehicles in the country is 519,025. They were manufactured in the period from 1975 to 2013. The total number of registered vehicles manufactured in the period 1975 to 2004 is 444,184 (321,549 passenger cars, 3,574 buses, 108,350 trucks and 10,711 special purpose vehicles). Majority of the vehicles are manufactured in the period of 1994-2003 (figure 5-3). By regions, 80.9% of these vehicles had been manufactured in Asia, 18.4% in Europe and 0.7% in America.

Figure 5-3: Number of registered vehicles per year of manufacture



Source: New POPs – report of industrial POPs chemicals inventory.

The total number of imported used vehicles produced in the period 1970-2009 is 167,639. It includes 117,023 passenger cars, 4,981 buses and 45,635 trucks. Majority of these vehicles had been produced in the period 2001-2004. The figure 5-4 provides illustration of the problem with the old vehicles in Mongolia.

Regarding POPs-PBDEs in other uses, Mongolia does not produce PUR foam for furniture, only imports materials and ready-made products to use in furniture and mattress production. Furniture and mattresses are mainly imported from China, Russia, EU, Korea, Malaysia and Hong Kong. Waste materials from furniture and mattresses such as PUR foam and mattresses are disposed together with household wastes.

Mongolia produce knitted products, clothes and carpets from sheep and camel wool and cashmere. These products do not contain synthetics and usually made from natural materials and do not apply flame retardants. Insulation materials (foam) for construction are imported and there are also some productions using imported raw materials. No information received so far that these productions use PBDEs.

Figure 5-4: The problem with the old vehicles in Mongolia

Note: Presented street is near the main square in Ulaanbaatar. The photo is captured on 25.4. 2014.

All types of wastes and discharges from households and operations go to household waste landfills or open dump sites. Therefore, landfills and dump sites are potentially be contaminated with POP-PBDEs.

5.2.2 Results of the new industrial POPs inventory

The inventory of the new industrial POPs was done in the period from December 2013 to February 2014. It was first inventory of the new industrial POPs in the country. The inventory was made in following sectors: (i) electrical & electronic equipment; (ii) transport; and (iii) other uses.

Inventory of EEE containing POP-PBDEs was made through data collection based on two types of questionnaires: (i) questionnaire form for households and (ii) questionnaire form for institutional and corporate consumers. Responses of 2,340 households, 908 institutional consumers and 379 corporate consumers were received. Inventory of POP-PBDEs in the transport sector was made through data collection based on questionnaire for cars and other vehicles in use or cars and registered vehicles and data about imported cars and other vehicles from the General Customs Authority. Inventory of POP-PBDEs in other uses was conducted based on the information collected from manufacturers through official letters.

The estimation of the POP-PBDEs is based on assumed relative content of PBDEs per piece of equipment or type of vehicle with respect of the year of production and country of origin (only for vehicles). In addition, screening of EEE/WEEEs for bromine was made and some samples detected with high bromine content have been sent to a laboratory in Germany for high precision analyses.

In 2000-2012, Mongolia imported 47,741 tons of category 3 and 4 EEEs, including 15,724.6 tons of 1,672,875 pieces of TVs and 18,287.7 tons of 1,847,195 pieces of computers. Of the total EEEs, 3,834.5 tones was CRT monitor and 1,014.8 tones was non-CRT, which contain 7.2 tons of c-OctaBDE (CRT monitors - 7.04 tones and non-CRT - 0.192 tones).

Among the total number of EEEs, households use 92,196 pieces of CRT computer monitors (1,300 tones), institutional consumers 19,851 pieces (279.9 tones) and corporate consumers use 28,433 pieces (400.9 tones), making up the total number at 140,480 pieces or 1,980.8 tons of CRT appliances on national scale.

For the CRT television, households – 299,637 pieces (9,468.53 tones), institutional consumers – 6,938 pieces (219.3 tones) and corporate consumers – 21,634 pieces (683.6 tones). So, the total number was 328,210 pieces or 10,371.5 tons of CRT TVs in the country. Total content of c-OctaBDE in CRT appliances was calculated as 4.22 tones (CRT computer monitors - 1.51 tones and CRT televisions - 2.71 tones).

Table 5-1: Estimated amount of POP-PBDEs

	Distribution homolues c-PentaBDE	In current use	Imported	End-of-Life	Disposal Sites
Inventoried c-POP-PBDE		58129.7	95116.6	15.5	-
TetraBDE	33%	19182.8	31388.5	5.1	-
PentaBDE	58%	33715.2	55167.6	9.0	-
HexaBDE	8%	4650.4	7609.3	1.24	-
HeptaBDE	0.5%	290.6	475.6	0.08	-

Source: New POPs – report of industrial POPs chemicals inventory.

Volume of waste to be generated from the total number of CRT appliances: CRT computer monitor – 276.9 tones, containing 211 kg c-OctaBDE, and CRT TVs – 1,154.3 tones, containing 301.3 kg c-OctaBDE. Summing this up, a total of 12,352.3 tons of waste, containing 512.3 kg c-OctaBDE is generated in Mongolia.

From the amount of c-OctaBDE is calculated amount of POP-PBDEs (HexaBDE and HeptaBDE). Content of HexaBDE in imported EEEs was 795.8 kg, in in-use EEEs 463.8 kg, in waste 56.4 kg, and content of HeptaBDE in import EEEs was 3,110.7 kg, in in-use EEEs 1,813 kg and in waste 220.3 kg.

The estimated amount of total c-PentaBDE is 153.3 tones in vehicles (passenger cars, trucks and buses). The estimated amount of POP-PBDEs calculated from the amount of c-PentaBDE is presented in the table 5-1.

5.3 POPs Pesticides

The source of information is the report: Nationwide inventory of POPs pesticides (prepared by the Professor, Dr. Ch.Chuluunjav, Plants Protection Institute, Mongolian Academy of Science).

5.3.1 Important remarks regarding POPs pesticides in Mongolia

Mongolia is a country of traditional livestock husbandry. The first usage of pesticides in the country is in 1958 in animal husbandry. Also, the pesticides started to be used for plant protection as the result of the growing agricultural sector since the end of 1950s. The most widely used POPs pesticide in Mongolia is Hexachlorocyclohexane (HCH). HCH (12%), α-HCH (12%) and HCH emulsion (16%) had been used in 1958-1985 as an insecticide in livestock (for mites, scabs, ticks, bloodsuckers etc.), as well as for disinfecting animal shelters and ordure. HCH in powder form was mainly spread over small animals by hand. Washing animals with HCH solution, prepared by dissolving HCH emulsion with 16% concentrate into a hot water, was also a common practice. The solution poured into a pit (so-called bathtub), dug in the ground, and threw animals in it to wash. Therefore, serious contamination can be found in such places called “bathtub”. HCH has also been used for combating grasshoppers in 1965-1989 at the ratio of 8-10kg per hectare, spraying manually or using sprinkles.

The pesticides were mainly imported from former Soviet Union since 1990s. More precisely, HCH (12%) had been imported in the period 1958-1980, α-HCH in the period 1970-1980, HCH emulsion (16%) had been imported in 1980-1985. Later, as the country shifted to the free market economy, the imports of pesticides diversified with more markets such as China, Korea and Germany.

The first ever ban on the use of pesticides in Mongolia was in 1990, when the Minister of Environment and Food and the Minister of Agriculture banned the use of HCH 12% mixture powder by joint order. In addition, the Government of Mongolia approved the “List of Banned and Limited to Use Substances in Mongolia” in 1997, which banned the use and import of 10 POPs pesticides, namely, aldrin, chlordane, dieldrin, DDT, Alpha hexachlorocyclohexane, Beta hexachlorocyclohexane, lindane, heptachlor, toxaphene and endrin. This list was reviewed and renewed in 2007 into the “List of Banned and Limited to Use Toxic and Hazardous Chemicals”, adding hexachlorobenzene and mirex in 2007 and endosulfan, chlordecone and pentachlorobenzene in 2012. In 1999, the tripartite joint order by the Ministers of Environment, Health and Food, and Agriculture enacted new procedure to list the name and volume of pesticides, disinfection and sterilization substances on an annual basis and since 2007 the Ministry of Environment has been issuing the import permit for pesticides in the approved list in approved volume.

Mongolia does not produce pesticides (except the low volume of bio-pesticides). Also, the export of pesticides has not been reported in Mongolia.

5.3.2 Results of the POPs pesticides inventory

The inventory was conducted in the period December 2012 to May 2013. It was based on questionnaire survey. The questionnaire form was distributed to all related businesses, soum villages and districts and the collected information was consolidated. A total of 274 units in

Ulaanbaatar and 21 provinces responded to the questionnaire. The preliminary inventory was conducted in 2004.

According to the inventory, Mongolia used 5983.6 liters of Hexachlorobenzene in 17 soum villages of 9 provinces in 1969 – 2003, 311.5 liters of Chlordane in 6 soums of 6 provinces, 61 liters of Aldrin in 4 soums of 3 provinces, 162.5 liters of Dieldrin was used in 1 soum of 1 province as an insecticide, and 564.5 liters of Heptachlor in 6 soums of 3 provinces, respectively.

Stockpiles of 5,099 kilograms of HCH is being kept in Hovd soum of Hovd province, Jargalant soum of Tuv province, Davst soum of Uvs province, Harhorin soum of Uvurhangai, and Dundgovi provincial Veterinary, and 0,6 liters of HCB in Ugtaal and Jargalant soums of Tuv province.

6 Socio-economic impacts of POPs in Mongolia

This section presents the socio-economic impacts of POPs chemicals in Mongolia: Impacts leading to health hazards on humans; Exposure to vulnerable groups; Secondary impacts due to health hazards; Cost of contaminate soil and site remediation; and Cost of destruction and non existence of end of life and management and treatment. The recommendations are provided at the end (some of them are taken from the three POPs inventories).

6.1 Impacts leading to health hazards on humans

POPs are associated with serious human health problems. The health impacts on humans can be short term or long term. The short term impact includes poisoning, irritations in skin, eyes, and in mucus membranes. The long term impacts are carcinogenic effects, immunological effects, endocrine disruption by some POPs, neurological effects, developmental effects, effects on reproductive system etc. In addition, laboratory studies have shown that low doses of certain POPs can adversely affect organ systems. Chronic exposure to low doses of certain POPs may affect the immune and reproductive systems. Exposure to high levels of certain POPs can cause serious health effects or death (United States Environment Protection Agency, 2014).

The impact of toxic chemicals on health diseases is same or even higher in developing and transition countries as Mongolia. The Poisoned Poor documents, prepared by the GAHP (Global Alliance on Health and Pollution, 2013), summarizes the toxic chemicals exposures in low- and middle-income countries. They estimates that amount of disease caused by toxic exposures is similar to that of malaria or outdoor air pollution in those countries. In addition, there is growing body of studies (as for example Clapp et al., 2005, Scheringer et al., 2012, UNEP and WHO, 2013) that highlights the crucial role of POPs, POPs-like chemicals and otherwise toxic chemicals on health diseases.

Mongolian institutions do not monitor and analyze the possible effects of POPs chemicals on human health in the country. However, the possible health effects from POPs chemicals identified with the three POPs inventories in Mongolia (dioxins and furans, PBDEs, HCH, chlordane and aldrin) could be find in many relevant studies.

1. Dioxins. Short-term exposure of humans to high levels of dioxins may result in skin lesions, such as chloracne and patchy darkening of the skin, and altered liver function. Long-term exposure is linked to impairment of the immune system, the developing nervous system, the endocrine system and reproductive functions. Chronic exposure of animals to dioxins has resulted in several types of cancer. The developing fetus is most sensitive to dioxin exposure. Also, workers in industry and at hazardous waste sites are more vulnerable to the dioxin effects than the average population (WHO, 2014).
2. PBDEs. PBDEs are accumulated within food chains, which have very serious health effects, while toxicity depends on the compound and the amount that one is exposed to. Laboratory studies on animals have shown them to be neurotoxic chemicals, neurobehavioral and developmental toxicants, and carcinogens. Schmidt (2003) and Birnbaum and Staskal (2004) find that PBDEs have noticeable effect on the thyroid and liver and they impair learning, memory, sexual development, and behaviour. Additionally, PBDEs and PCBs can interact and enhance neurobehavioral defects when the exposure occurs during a critical stage of neonatal brain development (Eriksson et al, 2004).
3. HCH. In humans, the main target of acute exposure to high amounts of HCH is the nervous system, and the effects consist of hyperexcitability, seizures, and convulsions that eventually may lead to death. Studies of the cancer of HCH in humans have been inconclusive. They find that HCH is not a major factor in the development of the disease, but may play some role. There is no evidence that HCH alters immune competence in humans (United States Environment Protection Agency, 2005).
4. Cholrdane. Most health effects in humans that may be linked to chlordane exposure are on the nervous system, the digestive system, and the liver. Large amounts of chlordane taken by mouth can cause convulsions and death. Swallowing small amounts or breathing air containing high concentrations of chlordane vapors can cause a variety of nervous system effects, including headaches, irritation, confusion, weakness, and vision problems, as well as upset stomach, vomiting, stomach cramps, diarrhea, and jaundice. There are indications that chlordane may cause anemia and other changes in the blood cells, but the evidence is not very strong (United States Environment Protection Agency, 1995).
5. Aldrin. The main and best documented effect of acute high-level exposure to aldrin in humans is central nervous system excitation culminating in convulsions. Central nervous system stimulation is the cause of death in acute poisoning. Longer-term exposure of humans in occupational settings has also been associated with central nervous system intoxication, but other toxic effects in workers routinely exposed to these pesticides have not been conclusively established. A few case reports have attributed liver and kidney toxicity and hemolytic anemia to oral exposure to aldrin or dieldrin, but these effects were not observed in larger occupational studies (United States Environment Protection Agency, 2002).

The risk of health effects in humans, as in the case of other toxic substances, depends of many factors, such as: the pathway of exposure (ingestion, dermal contact or inhalation), the quantity and frequency of exposure (for example, whether it is a large amount in a single event, or it is a daily exposure in smaller quantities), the health condition of the person and the exposure of other toxic substances of the person that may be associated with health effects.

6.2 Exposure to vulnerable groups

POPs have a particular impact on children and reproductive health of women. The children have in average higher exposure for new listed PBDE in comparison to adults (United States Environment Protection Agency, 2010). POPs and other pollutants could be transferred during pregnancy to the fetus and vie breast milk to the baby, which create developmental and other adverse effects. From the new listed POPs, PFOS has been correlated to subfecundity and PBDE correlated to reduced IQ in children (Fei et al., 2009; Herbstman et al., 2010).

The reduced IQ in population have negatively impact on the productivity in Mongolian economy. For example, an study examined the role of decreased brain development due to methyl mercury on lost economic productivity in the US (Global Alliance on Health and Pollution, 2013). The analysis found that 600,000 children suffered loss of IQ annually as a result of mercury pollution, leading to economic productivity losses of 8.7 billion US dollars annually. These types of analyses would have to be conducted in Mongolia in order economic costs for the Mongolian economy to be isolated, but the US study can be used as an indicator of significant implications for economic growth.

The reproductive health of men is also impacted by POPs and other chemicals. The sperm quality is decreasing in the developed countries in the last 50 years as the results of the negative influence of chemicals, including POPs (Sharpe, 2009; Jurewicz et al. 2009). The Mongolian Ministry of health should start monitoring this phenomenon.

Also, the poor people in Mongolia are important vulnerable group related to POPs chemicals. They faced the highest risk of exposure to hazardous chemicals due to their occupations, living conditions, lack of knowledge about safe handling practices and limited access to uncontaminated food and drinking water. The most toxic sites tend to be in poorer neighborhoods. Poor neighborhoods usually do not have access to improved water or sanitation facilities. People living there are more likely to be exposed to toxic impacts because they often engage in hazardous activities as part of their everyday survival. In addition, poverty is often associated with poorer health and nutrition, both of which can magnify the effect of toxic exposures. Mongolian authorities should engage in creation of healthier environments because they lead to healthier workers, families and children, who can be more productive members of society.

6.3 Secondary impacts due to health hazards

The health implications of toxic exposures from POPs chemicals are direct, while the socio-economic consequences of such exposures are indirect, but no less real. These secondary impacts due to health hazards include:

- Shortening of the life span;
- Loss of quality of life;
- Expenditure on health treatments;
- Investments to introduce measures for prevention and control of emissions of POPs.

It is important to note that health problems have also impacts on occupation and productivity, as for example:

- Loss of productivity and lowering of work efficiency.
- Increased sick leave and early retirement of trained and skilled workers.
- Need for appointment and training of new workers take the place of casualties.
- Payment of compensation.
- Human suffering.
- Accumulation of POPs in fatty tissues of the body thereby bringing about various health hazards later on.
- Deposition of POPs residues on food substances and ingestion leading to bioaccumulation.

The following part of this subsection provide estimation of the disability-adjusted life year (DALY) in Mongolia and its monetary value as indicator of the POPs impacts on human health and its secondary impacts in Mongolia.

The disability-adjusted life year (DALY) relies on an acceptance that the most appropriate measure of the effects of chronic illness is time, both time lost due to premature death and time spent disabled by disease. One DALY, therefore, is equal to one year of healthy life lost. DALYs are calculated by taking the sum of the two components: (i) Years of life lost and (ii) Years lived with disability. WHO has estimated DALY rates per 100,000 of population for long list of causes for all of its member countries. Mongolia has DALY rate of 42,935 per 100,000 people in 2012. It is consisted of the following three components: Communicable, maternal, perinatal and nutritional conditions (5,989/100,000), non-communicable diseases (32,462/100,000) and injuries (4,484/100,000). For comparison, DALY rate of Mongolia in 2000 was 55,523 per 100,000 people.

Not all components of the total number of DALYs are related to a single cause (e.g., POPs exposure or non-POPs chemical exposure). In order to estimate the DALYs related to POPs exposure, the approach presented in the World Bank project studies "Regional capacity building program for health risk management of POPs in South East Asia" is used. It is based on Lvovsky (2001), where is provided a rough order of magnitude of the DALY-rates associated with chemical exposure: "pesticides and non-point source industrial contaminants" and "pollutants from fossil fuels". It is considered that the burden of disease potentially associated with chemical exposure could be estimates as a percentage of the summation of DALYs over following diseases: liver and pancreatic cancer, melanomas and other skin cancers, lymphomas and multiple myeloma, endocrine disorders, unipolar major depression, cataracts, nephritis and nephrosis, rheumatoid arthritis, congenital anomalies (excluding spina bifida and congenital heart anomalies) and poisoning across all age groups. According to Lvosvky (2001), the percentage of the DALYs in these disease categories that can be attributed to chemical exposure is assumed to vary between 5% (conservative) and 20% (liberal). The shares of total DALY rate related to chemical exposure for Mongolia are: 0.56% (conservative) and 2.25% (liberal).[1] The DALY rates per 100,000 people related to chemical exposure in Mongolia are (based on 2012 overall DALY rate): 240 (conservative) and 966 (liberal). However, at a site-specific scale, the relative significance of the various causes of diseases may vary significantly from the average established at the country level.

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[1] The relative shares are calculated on data for the year 2000, because due to not publicly available DALY rates for the specific disease in 2012.

A monetary value can be ascribed to a DALY to reflect the economic cost of one lost year of ''healthy” life due to premature death, poor health or disability. This value is determined by the approach proposed by Lvovsky et al. (2000). According to this methodology, the value of DALY is obtained by dividing the Value of the Statistical Life (VSL) by the number of DALYs associated with premature death caused by POPs. VSL corresponds to the value society places on reducing the statistical probability that one among them dies (Viscusi 1992, 1993). Mrozek and Taylor (2002) using meta-analysis in which they revived more than 40 studies provided reliable estimate of the VSL in United States (USA). They estimated that VSL range from approximately 1.5 million US dollars to 2.5 million US dollars in 1998. The mid-point of this range, an average VSL of 2 million US dollars can be used as point estimate for VSL of USA in 1998. Adjusting this value for inflation in the period 1998-2013 (using data provided by the US Bureau of Economic analysis), the estimate for VSL is escalated to 2.8 million US dollars in 2013. The value of DALY for USA is obtained by division of the VSL by the number of DALY corresponding to premature death. It is assumed population to stand on average loss of 22 DALYs per premature death according to the age –distribution of DALY (World Bank, 2009). The value of DALY in the USA, in 2013 is therefore 127,273 US dollars (2.8 million divided by 22). This value should be adjusted to reflect the Mongolian economy, people earning power and local prices. An indicator for these differences between Mongolia and USA is GNI per capita in PPP. According World Bank Developments indicators, Mongolia has GNI per capita, PPP (in current international dollars) of 8,810 in 2013, while USA of 53,960 in the same year, which is relative difference of 6.12. Therefore the value of DALYs for Mongolia in 2013, using Lvovsky et al. (2000) approach is 20,780 US dollars. It is based on the thinking that economic value placed on health benefits by a population can be related to the level of economic prosperity.

6.4 Cost of contaminate soil and site remediation

The securing or remediation of POPs-contaminated sites is very costly, generally in the order of tens or hundreds of millions of dollars. Secured landfills and secured production sites need to be considered as constructions not made for 'eternity' but built for a finite time scale. Accordingly, they will need to be controlled, supervised and potentially repaired/renewed. Furthermore, the leachates and groundwater impacted by these sites will require ongoing monitoring and potential further remediation. These activities result in high maintenance costs, which are accrued for decades or centuries and should, therefore, be compared to the fully sustainable option of complete remediation. The contaminated site case studies highlight that, while extensive policies and established funds for remediation exist in most of the industrialised western countries, even these relatively well-regulated and wealthy countries face significant challenges in the implementation of a remediation strategy (Weber et al. 2008). For example the European Union for the rehabilitation of industrial sites has been allocated through the Structural Funds a total budget of 2.250 billion EUR in the period 2005-2013, and additionally, national expenditure for the management of contaminated sites are on average about 12 EUR per capita (European Environmental Agency, 2014).

This highlights the fact that for Mongolia only the prevention of contaminated sites represents a sustainable solution for the future. In addition the “Polluter Pays Principle” needs to be applied in a country to current problems and those which may emerge in the future. To promote the internalization of environmental and social costs and the uses of economic instruments, taking into account that the polluter should bear the cost of pollution with due regard to the public interest considering Principle 16 of the Rio Declaration. This is especially important, with the continuing shift of industrial activities in developing and transition economies, which often have poor regulation, as the Mongolian case.

6.5 Cost of destruction and non-existence of end of life management and treatment

Mongolia does not have adequate infrastructure for end of life management and treatment of POPs chemicals. Export of POP-contaminated materials back to the original producers, normally industrial countries, for destruction is very expensive at about 2,000 to 5,000 US dollars per ton. The Mongolian government has limited financial resources to efficiently respond to the accumulated POPs problems through international financing schemes. Therefore it is necessary the former producers of chemicals to take their responsibility in the management of their products.

6.6 Recommendations

6.6.1 Recommendations for dioxin and furans

1. There is no study in Mongolia that analyses the adverse effects on human health of POPs. The Ministry of health should undertake the obligation to monitor and analyze the possible effects of dioxin and furans on human health, especially on the population which has the highest exposure.
2. Implementation of "polluter pays principle."
3. Implementation of projects and activities for increase the awareness among general population and policy makers about the socio-economic impacts of dioxin and furans.
4. Installation of sophisticated medical waste incinerators with APCS in hospitals and in applicable places due to fact that the medical waste comprises 36.0% of total PCDD/PCDF release in the country.
5. Implementation of the system of integrated pollution prevention and control in the business sectors that are identified as the sources of unintended POPs. The implementation of these measures from one side will reduce and control the POPs emissions, and from other side will create opportunities for opening new businesses (mostly small and medium enterprises) for utilization of certain waste streams and would create further opportunity for creating new jobs in the landfills.

6.6.2 Recommendations for new industrial POPs

1. The Ministry of health should undertake the obligation to monitor and analyze the possible effects of new industrial POPS on human health, especially on the population which has the highest exposure.
2. The policy makers to ban the import of the vehicles produced before 2004.
3. The policy makers to ban the import of used EEE that could contain new industrial POPs;
4. Implementation of projects and activities for increase the awareness among general population and policy makers about the socio-economic impacts of new industrial POPs.
5. Implementation of EEE waste management system for collection, separation, export and recycling.

6. Investment in the facility for recycling of end-of-life vehicles.
7. Development of national code of harmonized system for registering import of used EEEs, and obligations of custom authorities to classify EEEs as new and used.
8. Investment in capacity building for new industrial POPs analysis.

6.6.3 Recommendations for POPs pesticides

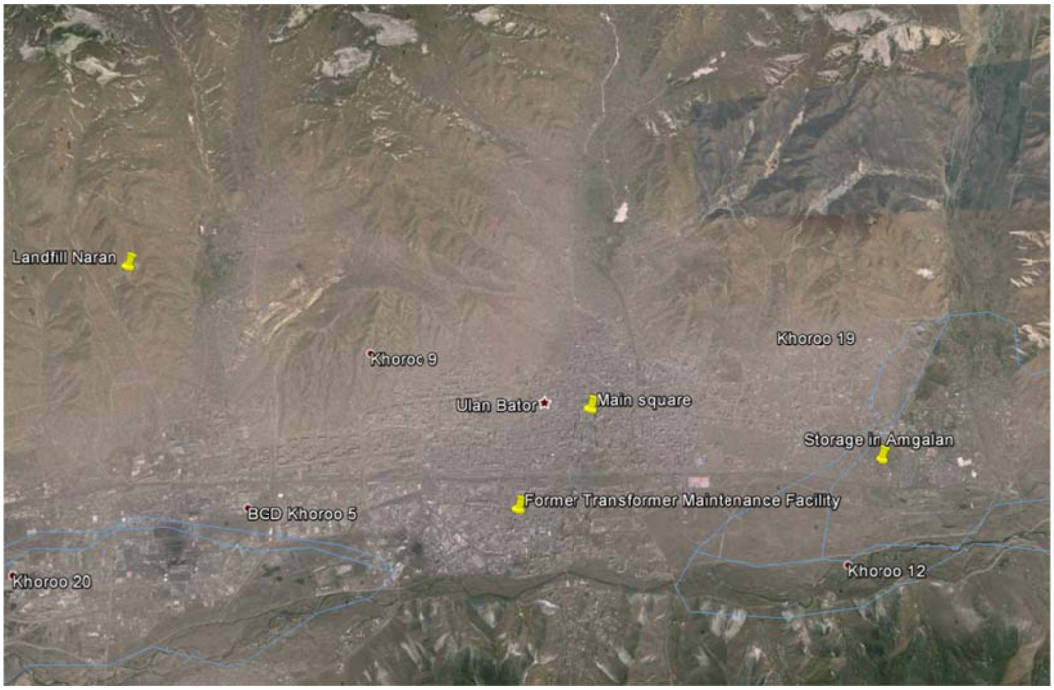
1. The Ministry of health should undertake the obligation to monitor and analyze the possible effects of POPs pesticies on human health, especially on the population which has the highest exposure.
2. The government must focus on the proper implementation of the POPs pesticides regulation in the country.
3. The government needs to pay attention to the disequilibrium in pasture land and plants protection policy in recent years, and to re-establish the "National Plants Protection Office", which should coordinate the government policy on plants protection substances.
4. Reinforce customs control over pesticides for agriculture and disinfection.
5. Build laboratory and experts capacity for pesticides and detecting contamination in soil and water, as well as in food products.
6. Instigate an environmentally sound disposal of POPs and other pesticides stockpiles.
7. Make survey of contaminated sites, polluted with POPs and other pesticides throughout the country and build database with detailed information on every single soums and provinces.
8. Instigate environmentally sound decontamination measures for the sites contaminated with POPs and other pesticides.
9. Reduce the usage of chemical pesticides and encourage the usage of biological pesticides.
10. Intensify trainings and information dissemination on proper usage of agricultural pesticides.
11. Strengthen the inspection on pesticides storage and usage with specific focus on practicing shelf life, technological norms and standards.
12. Urge periodical trainings and induction on labor protection and safety regulations to the workers who handle pesticides.
13. Reduce the usage of chlorine ($Ca(ClO)_2$) and chloramine ($CH_3C_6H_5SO_2NClNa* H_2O$) for the hygienic and disinfection purposes and encourage alternatives.

7 Potential Hot-spots

The identification of the potential hot-spots is done through the semi-structured interviews with the experts who prepared the POPs inventories in Mongolia: Dr. Ch.Chuluunjav, Dr. B.Bayarmaa and Dr. B. Avid. The semi-structured interviews were performed on 21.4.2014. The National Project Team confirmed the identified potential hot-spots. Finally, the potential hot-spots were discussed and approved on the Workshop with all stakeholders on 22.4.2014.

The following three hot-spots were identified: (i) Storage in Amgalan, Bayanzurh District, Ulaanbaatar, (ii) Former Transformer Maintenance Facility in Ulaanbaatar, and (iii) Main waste landfill in Ulaanbaatar. The key reason for their identification are the possible socio-economic impacts. All of them are located in Ulaanbaatar, which is the city with highest population density in Mongolia. The figure 7-1 presented their locations in Ulaanbaatar.

Figure 7-1: The locations of the three hot spots in Ulaanbaatar



7.1 Storage in Amgalan, Bayanzurh District

Site history and description

The source of information for the history of this is Dr. Ch.Chuluunjav. The site visit on 23.4.2014 provides data and information for the description of the site. The site visit was performed by: Ajani Adegboyega (UNIDO), Dragan Tevdovski (Socio-economic assessment expert), Ch.Chuluunjav (Plants Protection Institute, Mongolian Academy of Science), Jargalsaihan Ikhaasuren, Ariunbileg Radnaa and Myagmarsuren T. (National Project Team, Ministry of Nature and Green development).

The Storage in Amgalan is presented in the figure 7-2. It is located on the ground and buildings of the former prison. The site was used as the main storage site for imported pesticides in Mongolia, in the period from 1980s-1990s (ten to fifteen years) from where the pesticides were transported all over the country. It was closed in the 1990s., but it is evident that the buildings of the site are full with unknown amount and type of POPs pesticides. In addition, there are premises of the former prison underground which is believe that contain POPs pesticides even in higher amount than the buildings.

The area of the site was 1 hectare till the 1990s. Nowadays the area is significantly reduced by the yards and houses which are built on the periphery of the site area. The area of the underground premises is unknown due to unsafe access to them and absence of the underground maps. The site was owned by the Ministry of agriculture of Mongolia. Even today there is sign at the entrance of the site which clearly state that owner is this Ministry. However, the site was recently privatized by some officer in Ministry of agriculture.

The Storage in Amgalan is situated in 12 Khoroo, Bayanzurkh District in Ulaanbaatar. 12 Khoroo is sub-urban administrative unit of Ulaanbaatar. The maps of the broader and narower area are presented on the figure 7-3. The 12 Khoroo have 14285 inhabitants, who leave in small houses without access to water supply and sanitation. The total area of this administrative unit is 232,6 hectares.

Fifty meters from the entrance in the storage property is located building, which contains the administrative unit, medical unit and police unit of the 12 Khoroo.

There were no environmental data available regarding concentrations of contaminants in soil, sediment or animal tissues. However, the National Project Team is taken obligation to make the environmental samples analysis from this site in the near future.

Identification of receptors

Receptors are the living organisms – humans, animals and plants that may be affected by exposure to a chemical hazard. Potential receptors were identified using the field interviews done during the site visit with: (i) the guard of the Storage property, (ii) the doctor in the administrative unit, (iii) the Head of the administrative unit and (iv) three people randomly selected who live around the Storage property.

The potential Human receptors related to Storage in Amgalan are presented in table 7-1. The guard of the Storage property with her family and the residents of 12 Khoroo in Bayanzurkh District are considered to have greatest potential of exposure to POPs pesticides. The guard family lives on the Storage property in the past 20 years. The family has three children (15 years old, 5 years old and 1 years old). The guard has 65 years and she had been 3 times hospitalized this year. In total 14285 residents live in the administrative unit 12 Khoroo, Bayanzurkh District (including the guard family). The age structure of the residents is presented in the table 7-2. The average monthly household income of the residents is unknown, but it is evident that it is poor part of Ulaanbaatar, where approximately 40 percent of residents are unemployed. In addition, staff of the administrative unit, medical unit and police unit may also be potentially exposed. These three units started with work from September 2013, so there is only 10 months of their possible exposure till now.

Figure 7-2: Photos from the Storage in Amgalan, Bayanzurkh

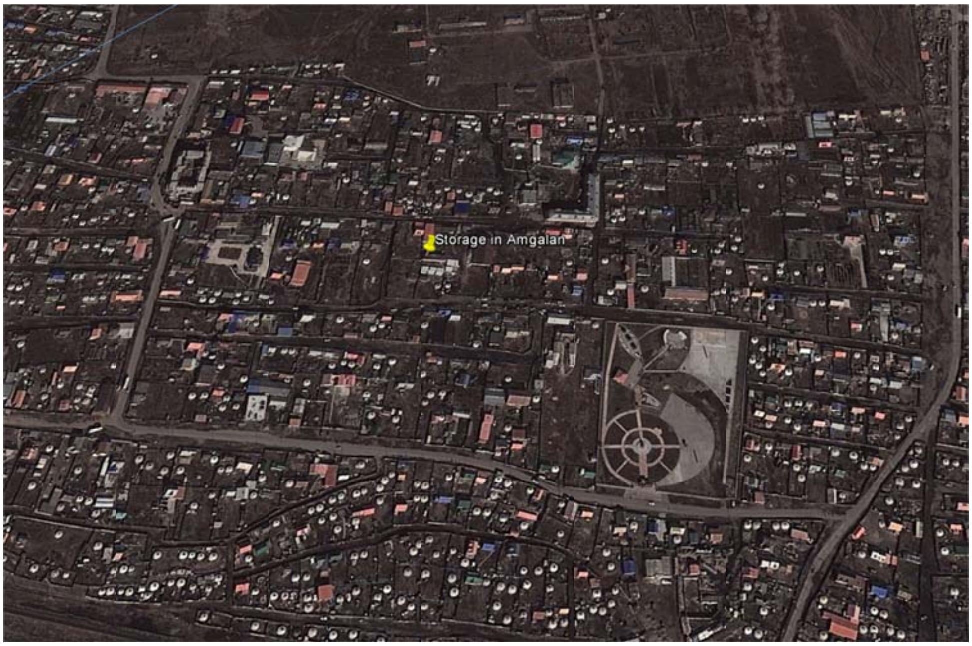
a) Main storage building

b) Houses near the site

c) Water supply of the resident on 20 meters away from the Storage entrance

Source: The photos are taken during the site visit on 23.4.2014.

Figure 7-3: Location of the Storage in Amgalan and Its Immediate Its Immediate Vicinity, 12 Khoroo, Bayanzurkh District, Ulaanbaatar



There were no documented cases of human health problems caused by POPs from this site. However, the general problem in Mongolia is not existence of the capacity for analysis of the POPs concentration in human blood or mother breast milk. The National Project Team is taken obligation to make these types of analysis related to potential contamination from this site in the future, by sending the samples in the relevant laboratories abroad.

The interviewed doctor pointed the following most frequent diseases in administrative unit 12 Khoroo of Bayanzurkh District: respiratory diseases, diabetes, heart problems, gastro ingestion diseases and kidney diseases. These diseases could be caused by the POPs contamination. In addition, the incidence of cancer among residents is 1:1800. The interviewed Head of the administrative unit pointed that allergies are very common in this area. However, it is important to note that all interviewed persons were not aware of possible contamination from the Storage site.

Table 7-1: Potential Human receptors related to Storage in Amgalan

Types of potentially exposed	Estimated numbers
Guard and her family who live on the Storage property	5
Staff of the administrative unit, medical unit and police unit	25
Residents of 12 Khoroo, Bayanzurkh District (excluding guard and her family and staff of the administrative unit, medical unit and police unit)	14255
Total	*14285*

Table 7-2: Age structure of the residents of 12 Khoroo in Bayanzurkh District

Age	Number of residents
0-7	1900
8-18	2614
19-64	9158
65 and more	613
Total	*14285*

Identification of pathways

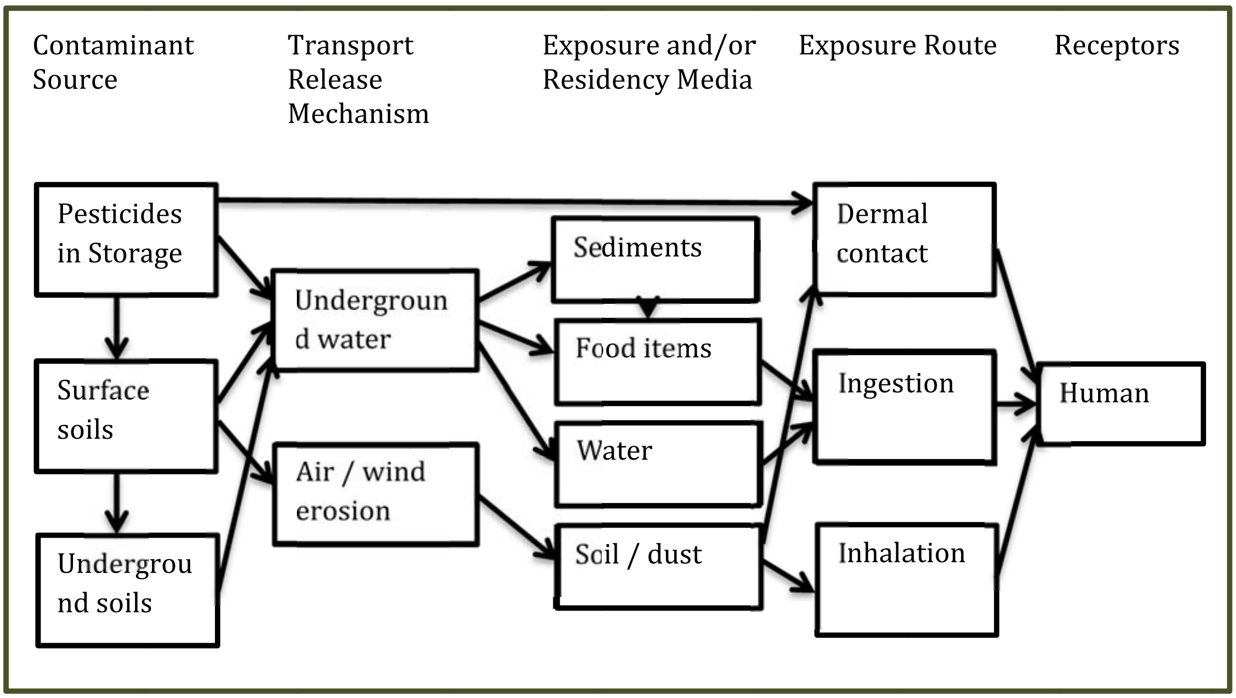
An exposure pathway is the route a chemical hazard follows to reach and affect a receptor. There are several potential exposure pathways specifically related to Storage in Amgalan:

- Ingestion of potentially contaminated underground water. The residents in the administrative unit (12 Khoroo in Bayanzurkh District) mainly use for drinking underground water and water from container tanks. In the administrative unit there are in total 23 underground wheels and 9 container tanks. There is a wheel on the Storage site and also there is one which is 20 meters far from the Storage site main entrance.
- Ingestion of potentially contaminated agriculture products. The residents in the administrative unit produce vegetables (mostly potatoes) on the soil near the Storage site with usage of water from wheels. They do not sell the vegetables on the market. Only produce them for their family use.

- Dermal contact of potentially contaminated water and soil. The residents use the water from wheels for washing. Also, there are activities of construction of the houses near the Storage site. In addition, there are signs on the soil near the Storage site that there is pesticides pollution.
- Inhalation. The air on the Storage site smell on pesticides.

The conceptual exposure model for the Storage in Amgalan is presented on the figure 7-4. It illustrates how contaminated sources, exposure pathways, and receptors are linked together to form the potential for human health risk.

Figure 7-4: Conceptual exposure model for the Storage in Amgalan, Bayanzurkh



Estimation of the site-specific DALY rate

The WHO's total DALY rate can be used to estimate the number of DALYs related to POPs exposure at the site through application of the formula:

$$DALY_{Site} = \frac{DALYrate_{Mongolia} \times ShareDALY_{Chemicals} \times Population_{Site}}{100{,}000}$$

where $DALYrate_{Mongolia}$ is the total DALY rate of Mongolia, $ShareDALY_{Chemicals}$ is share of the DALY rate that can be attributed to chemical exposure (as the best proxy of POPs impact), and $Population_{Site}$ is the potentially exposed population at the site. Using the total DALY rate of 42,935 per 100,000 people in Mongolia (provided by WHO), the share of DALY rate that can be attributed to chemical exposure in the country of 1.405% (estimated as the average of the two scenarios from the Section 6), and the potentially exposed population at the site of 14,285, gives a total number of

DALYs at the site equal to 86. This value transformed in the monetary terms is equal to 1.79 million US dollars (using the monetary value for one DALY for Mongolia from Section 6).

7.2 Former Transformer Maintenance Facility

Site history and description

The source of information for the history of this site is National Project team. The site visit on 23.4.2014 provides data and information for the description of the site. The site visit was performed by: Ajani Adegboyega (UNIDO), Dragan Tevdovski (Socio-economic assessment expert), Jargalsaihan Ikhaasuren, Ariunbileg Radnaa and Myagmarsuren T. (National Project Team, Ministry of Nature and Green development).

The Former Transformer Maintenance Facility is situated in Khan-Uul District, 3 Khoroo, Chinggis Avenue in Ulaanbaatar. The area was industrial zone in the past, but many new apartment buildings are built in the recent time. The maps of the broader and narrower area are presented on the figure 7-5. The Khan-Uul District, 3 Khoroo is located on 373 hectares and accommodates 10983 residents (2820 households) and 375 firms. Among the firms, there are 3 food processing factories in the close are of the site.

The owner of the Former Transformer Maintenance Facility site is Ulaanbaatar Electricity Distribution Network Stock Company. The total area of the site is 160 square meters. The site was used as transformer maintenance facility in the period from September 1967 to September 2011. In 2013, the company started to build sport hall at the site for its employees. The present construction activities are shown on the figure 7-6. The chemical analysis of samples of the soil and sludge collected in October and November 2011 (before the construction activities on the site to start) provide an evidence for PCB contamination. The management of the company was informed for the situation. However, the construction activities started and the company stated that they remove the contaminated soil and that they keep in some other location. But, the location is not known and accessible for the National Project team.

Figure 7-5: Location of the Former Transformer Maintenance Facility and Its Immediate Vicinity, Khan-Uul District, 3 Khoroo, Chinggis Avenue, Ulaanbaatar

Figure 7-6: Photo from the new building on the site

Source: The photo is taken during the site visit on 23.4.2014.

The details of samples of soil and sludge for PCB analysis that were collected from the site in October and November 2011 are presented in the table 7-3. The analytical results of the PCB analysis are presented in the table 7-4. The analysis was made by the Chemex Environmental International Ltd., Cambridge, UK.

Table 7-3: The details of samples of soil and sludge for PCB analysis collected from the Former Transformer Maintenance Facility site in October and November 2011

Sample No	Depth of sampling*, m	Comments
U1-1	0-0.5	sieved, mesh 2mm
U1-2	0.5-1.0	sieved, mesh 2mm
U1-3	1.0-1.5	sieved, mesh 2mm
U1-4	1.5-2.0	sieved, mesh 2mm
U1-5	2.0-2.5	sieved, mesh 2mm
U1-6	2.5-3.0	sieved, mesh 2mm

Notes: Diameters of boring auger: 127-146 mm; All samples had weight of approximately 100 gr each; The samples had been air-dried.

Table 7-4: Analytical results of the PCB analysis of the samples

Sample	Sample Wt,vol (g)	Final Ext vol (ml)	Scaling Factor	PCB 28 U Conc (ng/Kg)	PCB 52 U Conc (ng/Kg)	PCB 101 U Conc (ng/Kg)	PCB 118 U Conc (ng/Kg)	PCB 153 U Conc (ng/Kg)	PCB 138 U Conc (ng/Kg)	PCB 180 U Conc (ng/Kg)	Scaled MDL (ng/Kg)	Scaled QL (ng/Kg)
Blank 963	30	1	1.0	< 10	< 10	< 10	< 10	< 10	< 10	< 10	10	83
U1-1	30	500	528.0	5750	587000	947000	1910000	638000	1320000	92600	5280	44000
U1-2	30	200	205.3	4690	257000	444000	863000	375000	531000	47600	2050	17100
U1-3	30	50	50.5	1330	40300	73700	134000	64300	85100	6960	505	4200
U1-4	30	100	100.9	2470	66800	108000	193000	101000	138000	12900	1010	8410
U1-5	30	10	10.1	1070	12400	17300	26900	14000	17600	1620	100	800
U1-6	30	1	1.0	218	3420	5760	11700	5470	8030	662	10	100

Source: Certificate of Analysis, Chemex Environmental International Ltd.

It is necessary in the near future new samples of soil and underground water to be taken and PCB analysis to be made in order to be determined present situation on the site.

Identification of receptors

The potential Human receptors related to the Former Transformer Maintenance Facility site are presented in table 7-5. The present construction workers and the former workers in the transformer maintenance facility are considered to have greatest potential of exposure to PCB. However, the management of the company does not allow the interview with them or insight in their medical dossiers. In addition, residents in the administrative unit, the employees of the firms in the administrative unit and the consumers of the 4 food processing factories which are in neighborhood of the site may also be potentially exposed.

Table 7-5: Potential Human receptors related to Former Transformer Maintenance Facility

Types of potentially exposed	Estimated numbers
Construction workers	27
Former workers in the transformer maintenance facility	97
Residents of Khan-Uul District, 3 Khoroo	10983
Employees of the 375 firms of Khan-Uul District, 3 Khoroo	unknown
Consumers of the food processing factories	unknown
Total	11107

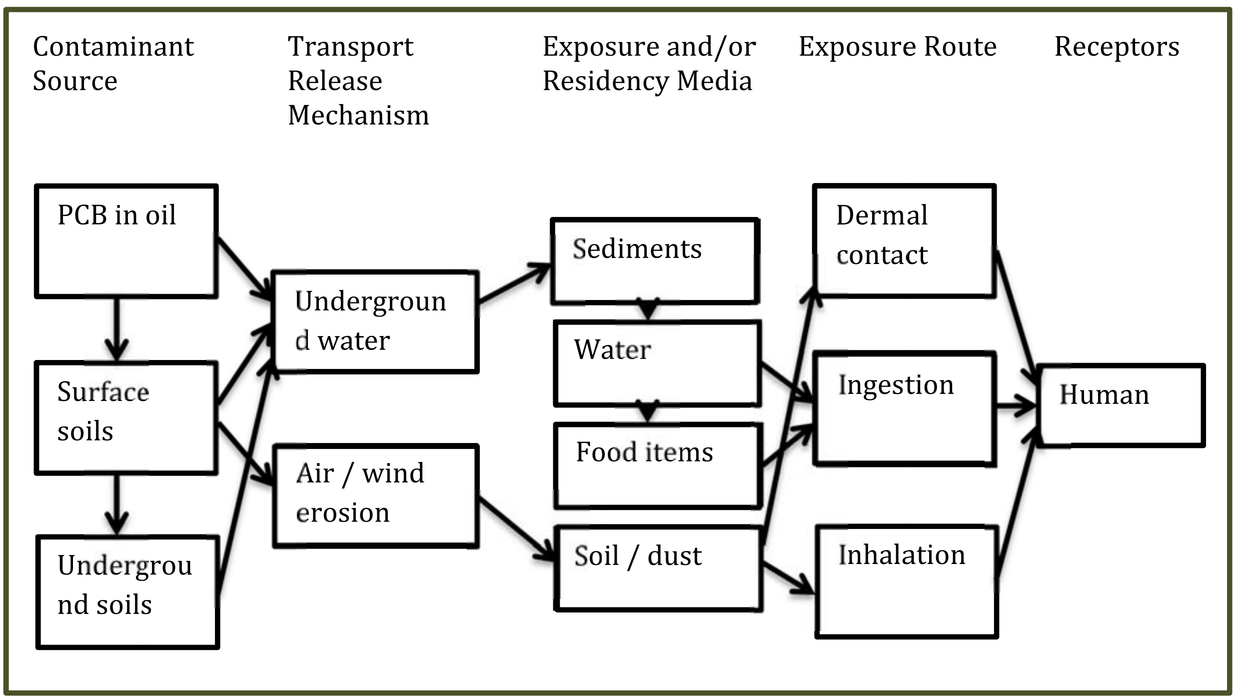
Identification of pathways

An exposure pathway is the route a chemical hazard follows to reach and affect a receptor. There are several potential exposure pathways specifically related to the site:

- Dermal contact of potentially contaminated water and soil through the construction activities on the site.
- Inhalation; the potentially exposure are construction workers, residents and employees in the area.
- Ingestion of potentially contaminated products from the food processing factories. These factories as the whole administrative unit (Khan-Uul District, 3 Khoroo) are connected to the central water supply. However, there is risk that the water pipes could be contaminated in the cases of the construction works or when the pipe is broken.

The conceptual model for the Storage in Amgalan is presented on the figure 7-6. It illustrates how contaminated sources, exposure pathways, and receptors are linked together to form the potential for human health risk.

Figure 7-6: Conceptual exposure model for the Storage in Former Transformer Maintenance Facility



Estimation of the site-specific DALY rate

The WHO's total DALY rate can be used to estimate the number of DALYs related to POPs exposure at the site through application of the formula:

$$DALY_{Site} = \frac{DALYrate_{Mongolia} \times ShareDALY_{Chemicals} \times Population_{Site}}{100{,}000}$$

where $DALYrate_{Mongolia}$ is the total DALY rate of Mongolia, $ShareDALY_{Chemicals}$ is share of the DALY rate that can be attributed to chemical exposure (as the best proxy of POPs impact), and $Population_{Site}$ is the potentially exposed population at the site. Using the total DALY rate of 42,935 per 100,000 people in Mongolia (provided by WHO), the share of DALY rate that can be attributed to chemical exposure in the country of 1.405% (estimated as the average of the two scenarios from the Section 6), and the potentially exposed population at the site of 11,107 gives (this is conservative view, the number may be strongly expanded if the employees of the 375 firms and consumers of the food factories are added) a total number of DALYs at the site equal to 67. This value transformed in the monetary terms is equal to 1.39 million US (using the monetary value for one DALY for Mongolia from Section 6).

7.3 Landfill Naran

Site history and description

The source of information for the history of this site is the National Project team. The site visit on 23.4.2014 provides data and information for the description of the site. The site visit was performed by: Ajani Adegboyega (UNIDO), Dragan Tevdovski (Socio-economic assessment expert), Jargalsaihan Ikhaasuren, Ariunbileg Radnaa and Myagmarsuren T. (National Project Team, Ministry of Nature and Green development).

The landfill Naran is located in Sanginokhairkhan District, 26 Khoroo in Ulaanbaatar. The maps of the broader and the narrower area are presented on the figure 7-7. This is the biggest landfill in Ulaanbaatar (there are two more landfills in the city). It receives the waste from 5 out of total 6 districts of the city, which amount between 900 and 1200 tons of waste per day, which include also industrial waste. It has total area of 52 hectares, but there are plans to be expand on 150 hectares in the near future. It operates under city municipality.

This site started to be used in the 1970s. Since 2009, it is based on landfills technology: registration of waste, soil coverage planning and waste receiving management. This technology was established by assistance of the Government of Japan. Before that it was open damn. However, there is no system for waste segregation. The present situation of the site is presented on the figure 7-8.

There is no documentation of the POPs contamination at the site. Therefore it is necessary in the near future samples of soil and underground water to be taken and PCB analysis to be made.

Figure 7-7: Location of the Landfill Naran and Its Immediate Vicinity, Sanginokhairkhan District, 26 Khoroo, Ulaanbaatar

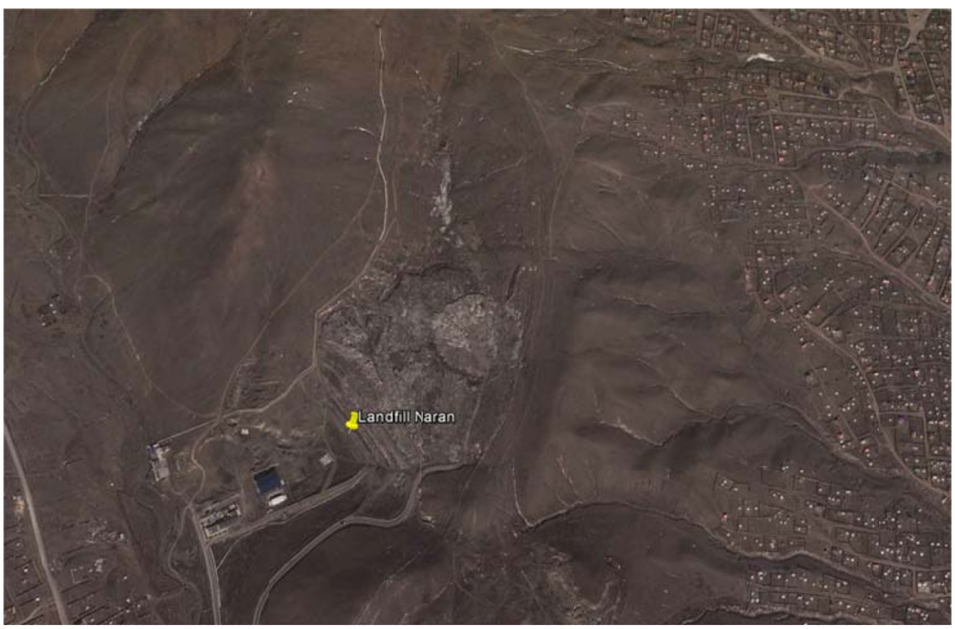


Figure 7-8: Photos from the Landfill Naran

a) The landfill and behind are the houses of the people

b) Cows on the landfill

Identification of receptors

The potential Human receptors related to the Landfill Naran are presented in table 7-6. The greatest potential of exposure have the employees at the landfill and the residents in the neighborhood of the landfill. The residents are poor people who live without access to municipality water system and sanitation system, so they use water from wheels and container thank. In addition, some of them collect the materials from the landfill, as for example, plastic bottles and metals. Also, there are cases of grazing of livestock inside the landfill area.

Table 7-5: Potential Human receptors related to Former Transformer Maintenance Facility

Types of potentially exposed	Estimated numbers
Employees at the landfill	30
Residents of Sanginokhairkhan District, 26 Khoroo	10600
Total	*10630*

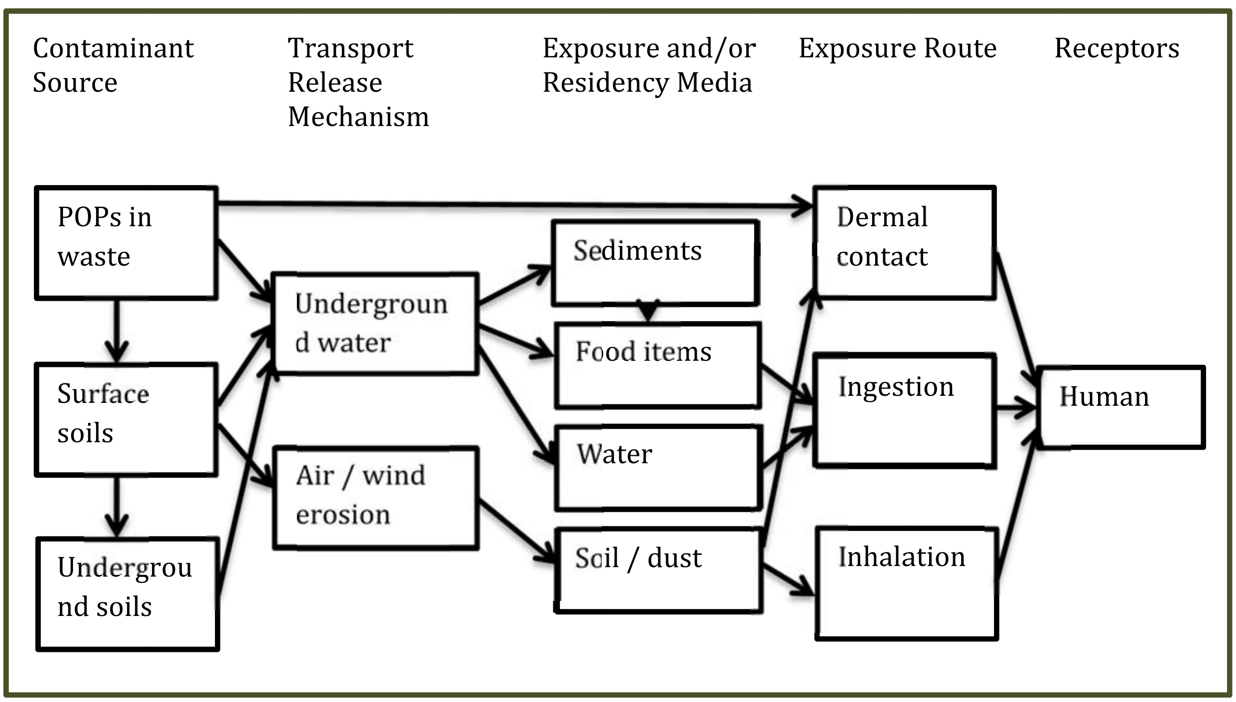
Identification of pathways

An exposure pathway is the route a chemical hazard follows to reach and affect a receptor. There are several potential exposure pathways specifically related to the site:

- Dermal contact of potentially contaminated waste and soil during the separation and collection of the waste by the people who live close to the landfill.
- Inhalation by the employees at the landfill and the residents.
- Ingestion of potentially contaminated milk or meat from livestock, which is grazing on the landfill. Also, there are possibility of contamination of underground waters that could make wheels water that is used by the residents.

The conceptual model for the landfill Naran is presented in the figure 7-9. It illustrates how contaminated sources, exposure pathways, and receptors are linked together to form the potential for human health risk.

Figure 7-9: Conceptual exposure model for the landfill Naran



Estimation of the site-specific DALY rate

The WHO's total DALY rate can be used to estimate the number of DALYs related to POPs exposure at the site through application of the formula:

$$DALY_{Site} = \frac{DALYrate_{Mongolia} \times ShareDALY_{Chemicals} \times Population_{Site}}{100{,}000}$$

where $DALYrate_{Mongolia}$ is the total DALY rate of Mongolia, $ShareDALY_{Chemicals}$ is share of the DALY rate that can be attributed to chemical exposure (as the best proxy of POPs impact), and $Population_{Site}$ is the potentially exposed population at the site. Using the total DALY rate of 42,935 per 100,000 people in Mongolia (provided by WHO), the share of DALY rate that can be attributed to chemical exposure in the country of 1.405% (estimated as the average of the two scenarios from the Section 6), and the potentially exposed population at the site of 10,630 gives (this is conservative view, the number may be strongly expanded if the employees of the 375 firms and consumers of the food factories are added) a total number of DALYs at the site equal to 64. This value transformed in the monetary terms is equal to 1.33 million US dollars (using the monetary value for one DALY for Mongolia from Section 6).

8 Socio-economic indicators for the monitoring and evaluation of National implementation plan in Mongolia

This section identifies five most important socio-economic indicators for the monitoring and evaluation of the National-implementation plan in Mongolia: Improved water source (% of population with access), Improved sanitation facilities (% of population with access), Poverty headcount ratio at national poverty line (% of population), Import of the cars older than 10 years and Progress in management of contaminated sites. The first three indicators are published by the World Bank, while the last two should be provided by Mongolian national statistics. The broad overview of the most important socio-economic indicators is provided in the section 1. The selection of the indicators is based on the findings of sections 5 and 6.

1. **Improved water source (% of population with access)**

This indicator refers to the percentage of the population using an improved drinking water source, which include piped water on premises (piped household water connection located inside the user's dwelling, plot or yard) and other improved drinking water sources (public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs, and rainwater collection). Only 84.6 percent of the Mongolian population has access to improved water source, which is lower than the average of the developing countries from East Asia & Pacific. The existence of the population in country which does not have the access to improved water source increases the risks of the impacts of POPs. For example, through drinking of possible contaminated water from wells. The target for this indicator in the long run should be reaching the average of the developing countries from East Asia & Pacific.

2. **Improved sanitation facilities (% of population with access)**

This indicator refers to the percentage of the population using improved sanitation facilities, which include flush/pour flush (to piped sewer system, etc.). Only 56.2 percent of the Mongolian population has access to improved sanitation facilities. This percentage is also lower than the average of the developing countries from East Asia & Pacific. The existence of the population in country which does not have the access to improved water source increases the risks of the impacts of POPs. The target for this indicator in the long run should be reaching the average of the developing countries from East Asia & Pacific.

3. **Poverty headcount ratio at national poverty line (% of population)**

This indicator refers to the percentage of the population living below the national poverty line. National estimates are based on population-weighted subgroup estimates from household surveys. Mongolia has 27.4 percent of the population in poverty in 2012. The relation of this indicator with the POPs management is due to the factor that the population in poverty has higher possibility of exposure on POPs contamination. The target for this indicator in the short run should be decrease of the population in poverty in country.

4. **Import of the used cars older than 10 years**

This indicator refers to the number of imported used cars which are older than 10 years. The indication is twofold. First, the cars produced until 2004 contained significant amount of POPs. Second, the imported used cars older than 10 years increase the need for waste management and make the country to be big landfill for used cars. The target for this indicator in the long run should be decrease of this indicator to zero.

5. **Progress in management of contaminated sites**

This indicator shows progress in key management steps of contaminated sites: preliminary study/site identification, preliminary investigation, main site investigation, and implementation of risk reduction measures. It estimates: the number of potentially contaminated sites, the number of contaminated sites, and number of cites under remediation. This indicator is used by European Environment Agency.

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