Incorporation of Environmental Law Requirements during Waste Management at Rubbish Recycling Plants in the Republic of Kazakhstan

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Abstract

Objectives: The research is aimed at improving the system of municipal solid waste handling; improving the efficiency, reliability, environmental and social acceptability of the complex of services on collection, transportation, recycling, processing and disposal of municipal solid waste; modernizing MSW sector based on advanced technologies and management practices, as well as taking measures to strictly comply with the Kazakhstan environmental law requirements.

Methods: Such scientific methods as research, analysis, synthesis and substantiation were used to study this environmental problem based on the works of both domestic and foreign scholars.

Findings: The authors carried out systemic legal and environmental-economic analysis of waste processing technologies and equipment enabling to assess the negative impact on the environment, as well as to study the requirements of environmental law during waste management at the rubbish recycling plants in the Republic of Kazakhstan. It has been proposed to apply life cycle assessment (LCA) in designing and selecting the best waste management option and provide support of rubbish recycling companies from the republican budget resources.

Application/Improvements: Implementation of the research will improve the quality of services rendered in MSW management, increase the amount of collected and recycled secondary material resources, allow taking full advantage of the MSW energy potential and minimizing the negative environmental impact as a result of MSW treatment. Thus, it will contribute to a significant improvement in the quality and conditions of life of citizens of the Republic of Kazakhstan.

Keywords: Environmental Code of Republic of Kazakhstan, Environmental Legislation, Law, Life Cycle Assessment (LCA), Republic of Kazakhstan

1. Introduction

The situation currently existing in the Republic of Kazakhstan in the field of waste management leads to dangerous environmental pollution, unsustainable use of natural resources, significant economic damage and poses a real threat to public health. The relevance of this study is determined by the need to involve the best technologies in waste management that are focused on the environment protection, introduction of modern low-waste technologies, and the use of high-performance equipment.

The Concept of transition of the Republic of Kazakhstan to “green economy”¹ approved by the Presidential Decree No. 577 dated May 30, 2013 indicated...
improvement of the management in the municipal solid waste (MSW) sphere as one of the main lines of activity.

Environmental Code of the Republic of Kazakhstan is the major instrument governing the MSW management in the country.

Requirements of the RK Environmental Code imposed on the waste management can be divided conventionally into three parts:

- Environmental requirements set up to individuals and legal entities whose business activities generate waste to be adhered to prior to the waste generation;
- Environmental requirements set up to individuals and legal entities whose business activities generate waste to be adhered to after the waste generation, including the requirements for waste accumulation, as well as the waste collection, processing, utilization, neutralization, transportation and storage (burial);
- Set up to individuals and legal entities whose business activities generate waste to be adhered during waste landfilling, as well as the requirements for waste landfills, including landfills to dispose of hazardous waste and radioactive burial sites.

Article 291 of the RK Environmental Code presents environmental requirements during construction and operation of enterprises, buildings, structures, erections and other facilities relating to waste management

"During operation of enterprises, buildings, structures, erections and other facilities relating to waste management individuals and legal entities shall undertake to:

- Develop draft standards for waste disposal, providing for measures to reduce them by processing, recycling, neutralization and safe disposal or transfer to individuals and legal entities engaged in these activities;
- Introduce low-waste technologies and organizational measures to reduce waste generation on the basis of the latest scientific and technological achievements;
- Draw up an inventory of waste and landfill facilities;
- Monitor the state of the environment in the territories of landfill facilities;
- Submit information associated with waste management pursuant to the procedure provided by the legislation of the Republic of Kazakhstan;
- Comply with the requirements for the prevention of accidents relating to waste management and take urgent measures to eliminate them;
- In the event of accidents or threats relating to waste management which are causing or may cause damage to the environment, health or property of individuals or legal entities to property, immediately inform the authorized environmental protection body and the state authority in charge of public sanitation and disease control and local executive bodies."

“Determination of the construction site of a landfill facility is based on the special (geotechnical, hydrogeological and other) survey in case of the positive conclusions of the state environmental expert review, sanitary-epidemiological expert review (when constructing facilities of high epidemiological criticality) and the examination carried out in accordance with the Kazakhstan law on Subsoil and Subsoil Use.”

All businesses are required to indemnify against the environmental damage caused as a result of their business activities. The damage they cause shall be indemnified in the form of fees for use of natural objects. In accordance with Article 101 of the Environmental Code of Kazakhstan provision is made for environmental emissions fee. Emissions to the environment are effluents, discharges of pollutants, production and consumption waste disposal in the environment, harmful physical impacts.

Almost all MSW landfills have exhausted their duration; it is required to reclaim them, to collect landfill gas, subject to economic feasibility, as well as to construct new regional engineering landfills. System of separate waste collection and separation at the MSW source remains practically undeveloped.

At the institutional level the MSW management sector infrastructure has not been fully established yet, the territories are fragmented in addressing this issue and there is no common policy in the field of waste management. To solve the existing problems in the sector it is necessary to introduce a regional approach for the entire waste management process chain – from separate collection at the source of waste to burial of inert part of MSW at the engineering landfills.

The introduction of economic incentive mechanisms into the MSW sector is directly linked to such issues as the removal of waste from garbage dumps, the development of segments of separate waste collection, separation, processing, recycling, and disposal. Therefore the priority actions in terms of economic incentives include:
a) Reduction in corporate income tax rates for rubbish recycling companies;
b) Exemption from property tax for rubbish recycling plants for a period of 7 years;
c) The introduction of accelerated tax depreciation for equipment used in the process of waste recycling.

If at the initial stage of the Modernization Program for municipal solid waste control system for 2014-2050 the level of tariffs, with regard to the availability threshold, is not sufficient to implement the retrofit of MSW management system due to the low solvency of the population, it is possible to use the following mechanisms of economic incentives for the implementation of this Program for private investors:

- Budget covering (for example, at the expense of the concession obligations under the contract of public-private partnership) of the difference in tariffs paid by the public and necessary to ensure full compensation for the investor's costs of the services including MSW collection, removal, separation, recycling, processing and burial;
- Guaranteeing part (up to 50%) of the investor's capital costs through a single center on projects and grants in the field of MSW.

The boundaries of environmental support for the proposed activity should be expanded by taking into account the impact of the full life-cycle of waste, starting from the consideration of the materials used in the production process and influencing the composition of the waste, the processes leading to waste generation and ending with the comparison of the waste burial, storage, transportation, processing and final disposal schemes.

Currently, rubbish recycling plants are operating in such Kazakhstan cities as Astana, Almaty, Shymkent, Taldykorgan. Thus, for example, within the territory of Almaty MSW recycling is the most acute problem. There is no well-developed and advanced infrastructure of waste processing and recycling in the city. Almost all the generated waste is placed without processing in landfills, many of which do not comply with sanitary, hygienic and environmental requirements for placement, arrangement and operation of such specialized facilities. The problem of industrial waste collection, disposal, burial and processing is one of the most pressing challenges of the environment state. The city of Almaty is characterized by insufficient development of secondary processing of waste due to the lack of infrastructure and economic incentives for businesses. The problem is the annual generation of a large amount of waste is associated with considerable consumption of materials during production cycles, using technologies that do not allow processing feedstock and materials to the fullest. The vast majority of organizations in the city are characterized by a high proportion of resource and material consumption, resulting in a significant waste generation.

Only 3–5% of garbage is processed in the Republic of Kazakhstan. So far 95% of total domestic waste just lie under the open sky and permanently pollute the air and soil. Therefore, municipal solid waste processing projects are more than urgent nowadays. In the developed countries, increasingly less waste is removed to the landfills and increasingly more MSW is processed in the industrial way. However, in Kazakhstan this problem has not been solved yet. Today, in the world practice secondary recycling ranges from 45% to 80%. For example, in Japan, about 45 percent of the waste is subjected to the secondary processing, 37 % - to incineration and waste removal to the landfill and subsequent storage takes only 18 percent.

In Almaty industrial emissions and municipal garbage dump have been polluted the city and surrounding areas for many years. Huge territories are used for landfilling.

In Kazakhstan, the volume of municipal solid waste (MSW) totals approximately to 15 million m$^3$ per year, i.e., 2 m$^3$ per an inhabitant.

As can be seen in Table 1 in the developed countries, solid waste emissions make 0.3-0.6 m$^3$ which is by 3–4 times less than in RK. In total, 3.2 billion municipal solid wastes have been accumulated in Kazakhstan. Major part of the waste falls on the big cities, where their accumulation varies from 1.3 to 2.6 m$^3$ per capita.

Table 1. Data on municipal solid waste component composition in various countries, %.

| Components    | US   | UK   | Canada | Japan | Spain  |
|---------------|------|------|--------|-------|--------|
| Food products | 23.9 | 27.0 | 10.0   | 30.3  | 40-50  |
| Paper         | 31.1 | 30.0 | 70.0   | 40.6  | 15-20  |
| Metals        | 9.5  | 9.0  | 5.0    | 2.3   | 3.5-5  |
| Glass         | 9.7  | 8.0  | 5.0    | 5.5   | 2.5-6  |
| Polymers      | 3.4  | 3.0  | -      | 10.8  | 3-8    |
| Textile       | 1.4  | 3.0  | -      | 2.5   | -      |
| Ash           | -    | -    | 5.0    | -     | -      |
| Other         | 21.0 | 19.1 | 5.0    | 8.0   | 35-10  |
Analysis of the current legal framework and statistics in recent years in the field of waste management in the Republic of Kazakhstan leads to the following conclusions.

Unfortunately, at present it is profitable for businesses rather to pay for waste disposal than to take measures on their recycling and utilization. The Environmental Code of Kazakhstan provides economic incentives for separate collection and processing of waste, but it is not applied in practice. The current methodology for the calculation of tariffs comprises only MSW removal and does not include MSW collection, recycling and disposal.

During the accounting and analysis of economic aspects and costs a systematic approach is applied in waste management that is based on a functional unit acting as the reference unit. This fact makes the systemic analysis useful for comparing different technologies, as it enables to determine the level of technology impact, for example, per one unit of output or per 1 ton of waste disposed.

2. Concept Headings

The aim of the study was to examine the ways of waste disposal, to propose more effective measures for waste neutralization and processing through the creation of rubbish recycling cluster. The practical significance of the study lies in the scientific and practical substantiation of conformity of the waste management system at the rubbish recycling plants to determine compliance with the best available techniques, to select technologies for processing of household and industrial waste ensuring observance of environmental requirements. This raises the need for a systemic legal and environmental-economic analysis of waste processing technologies and equipment enabling to assess the negative impact on the environment, as well as to study the requirements of environmental law during waste management at the rubbish recycling plants in the Republic of Kazakhstan. Such scientific methods as research, analysis, synthesis and substantiation were used in the course of study; the topic was studied based on the works of both domestic and foreign scientists.

3. Results

The total amount of MSW accumulated in Kazakhstan is about 100 million tons, and annually about 5–6 million tons of waste is formed. By 2025, this figure could rise to 8 million tons, while the resulting waste is deposited in landfills without prior separation and neutralization. Table 2 shows the distribution of the MSW placement at the landfills and municipal solid waste storage norms at the regional level (for 16 major cities).

Table 2. Data on municipal solid waste emissions in various regions of Kazakhstan, %.

| City                  | Population at the end of 2015, thous. people | MSW landfilling in 2015. | Rate of MSW accumulation per capita |
|----------------------|---------------------------------------------|--------------------------|------------------------------------|
|                      |                                              | thousand                 | m³/person per year                 |
| Astana               | 778.198                                     | 326.4                    | 2.16                               |
| Almaty               | 1475.429                                    | 549.12                   | 2.55                               |
| Aktau                | 180.885                                     | 109.7                    | 2                                  |
| Aktobe               | 420.567                                     | 360.6                    | 0.47                               |
| Atyrau               | 272.071                                     | 44.07                    | 0.56                               |
| Karaganda            | 478.952                                     | 132.85                   | 1.87                               |
| Kostanay             | 219.224                                     | 152.73                   | 1.17                               |
| Uralsk               | 271.361                                     | 108.5                    | 2.3                                |
| Shymkent             | 662.1                                       | 64.55                    | 1.7                                |
| Pavlodar             | 342.435                                     | 94.47                    | 1.30                               |
| Kokshetau            | 152.006                                     | 57.7                     | 1.16                               |
| Ust-Kamenogorsk      | 309.5                                       | 45.6                     | 1.98                               |
| Taldykorgan          | 156.162                                     | 17                       | 2.77                               |
| Taraz                | 343.275                                     | 34.96                    | 0.54                               |
| Kyzylorda            | 253.960                                     | 36.1                     | 1.7                                |
| Petropavlov-sk       | 206.043                                     | 62                       | 2.07                               |

MSW accumulation rates per capita at the regional level have a wide range from 80 to 400 kg/person per year, which implies the inconsistencies in the process of data collection and reporting. It should be noted that almost all MSW landfills in Kazakhstan lack scales in the waste reception area, i.e. tonnage is set by shifting cubic meters into tons, and the volume weight value is applied ranging from 250 to 300 kg per m³. According to the experience of European countries, the volume weight is 100–150 kg per m³.

This study examines the possibility to use the methodology of life cycle assessment (LCA) when designing and selecting the best option of waste management.
Available methodology for assessing life-cycle costs can also be useful for decision-making on selecting waste management options at the rubbish recycling plants, because it allows taking into account the costs that have been left out of the form, including the external costs. It is also necessary to take into account all the possible impacts on the environment at each stage, as well as all possible costs in each of the waste management options. Rubbish recycling plants operate in such Kazakhstani cities as Astana, Almaty, Shymkent, Taldykorgan.

A holistic examination of plastic waste life cycle, which links the chemical composition of plastic with the composition of polymer composite materials, and then with a final option of plastic waste handling, allows choosing the optimal variant of the polymer solution formulation that can help not only minimize waste impact on the environment, but also improve the properties of finished plastic products.

A specific point for the municipal solid waste life cycle assessment is that the beginning of the consideration of the life cycle is not the time when the materials become waste, but when there is a choice of components from secondary resources included in the products, which mainly determines the properties of these products, and the end of this consideration is the moment when the products and materials become emissions into the environment.

It is necessary to take into account the economic consequences when selecting a waste management option. Most cost calculation systems are designed to comply with the requirements of current legislation and normative-legal regulation, therefore they do not monitor and do not declare the costs associated with sustainability and economic efficiency. The costs are often hidden in overhead accounts and poorly managed.

LCA can be used to create scenarios based on which the total valuation will be performed. The inclusion previously excluded types of expenses in the decision-making process is the biggest advantage that can be derived from the use of LCA output data for a full economic assessment of the project cost.

When choosing alternatives of economic solutions from the economic point of view, the priority is given to the corporate needs. In this context, the internationalization of the external (public) costs which should ideally be included in the internal production costs and product price of pollutant enterprise.

4. Discussion

To take into account all the potential environmental and economic costs it is proposed to use the following classification.

- Capital and operating costs for environmental protection:
  a) The capital costs include the costs of construction of environment protection facilities (project development, coordination of works, land allotment, construction site preparation, building and engineering research costs, equipment testing, decommissioning, liquidation works), expenses for the purchase of pollutant entrapment equipment, its installation, and obtaining various permits and licenses, etc.;
  b) Operating costs include expenses for utilities, raw materials and consumables, replacement of equipment parts and its maintenance, for services provided by third parties under the contracts (waste reception, transportation), for personnel’s salaries and training.
- Payments for use of natural resources, pollution of the environment, for the implementation of compensatory measures and payoffs related to the restoration and reproduction of natural resources.
- Contingency fee that may arise as a result of the unexpected consequences of allowed or above-limit emissions. Costs of this type are associated with the risk; they are best described in the probabilistic terms (expected amount, the type, and likelihood that they will exceed a certain rate).

The following types of contingency fee are distinguished:

a) The cost of conformance. These are expenses for add-on technologies that can be associated with new requirements in the field of air protection or waste water discharge, or increased costs of hazardous waste processing outside the production site;
  b) To administrative or criminal penalties and fines;
  c) Contingent indemnity, recovery costs. Future costs for restoration (site cleaning) may be associated with accidental emissions from industrial processes, accidents during waste transportation and handling and other unforeseen situations;
d) Damage to natural resources, usually including expenses for recovery costs and expenses associated with the loss of resources, benefits or services obtained from the resources from the date of damage to full recovery;

e) The potential liability beyond the site. It may be caused by the waste disposal at the landfill outside the production site. Development and size of this type of costs are influenced by such factors as the number of responsible parties at the site; the amount of waste disposed at this site in relation to other parties; toxicity of waste;

f) Manufacturing process risks. Such risks may include costs associated with accidents, such as fire, loss of property, suspension of production due to the organizational and technical reasons.

- Intangible ('soft') costs are hard to calculate expenses which include consumer confidence, customer loyalty, conscious attitude of employees to work, relations with trade unions, corporate image, the relationship with the community. This category may include annual environmental reporting, activities for the maintenance of public relations, the cost of the voluntary environmental activities.

The probability of occurrence of this type of costs may be related to the overall reputation of the company, the past history of environmental incidents and relationships with investors, creditors, society and regulatory bodies.

There are the following types of such costs:

a) Costs associated with hiring and maintaining qualitative staff. It is proved that the performance of employees, their loyalty and discipline depend on the policies and statements of the company in the field of environmental protection and occupational health. Staff turnover can result in costs caused by the loss of production time and training new employees. Staff turnover can also adversely affect other workers and determine the decrease in employees' discipline and performance;

b) The company's market share may depend on the overall reputation of the company, its environmental reputation, as well as reporting on the previous environmental incidents. Market share reflects preference of consumers who are supposed to be aware of the environmental aspects of the company's activity.

The reputation of a leader in the sphere of ecology influences on the increase in sales among consumers who are sensitive to environmental issues. Publication of the 'green' reporting enables consumers to make a choice based on the environmental performance of the company.

Experience shows that in the event of an environmental disaster a plan is required for interaction with mass media which should be carried out with the support of top management. Another important requirement is the veracity of the information provided.

Due to the lack of research in this area in each case it is required to calculate value of this type of costs depending on the company. For example, if a large-scale ecological incident occurred by the scenario, there may be a reduction in the market share approximately by 1%. This assumption is made on the basis of the most pessimistic reports from the loss of consumer confidence in the Exxon Mobil Corporation5.

The costs for timely obtained permits do not affect the direct costs of the project development or the cost of obtaining permits. This type includes the cost of delays in obtaining permits and the related loss of working days, or benefits derived from obtaining permits during production.

Relationships are affected by emergencies or general 'green' image of the company, and news reports in mass media.

Investor relations can be assessed by measuring the effect of the company’s reputation on the share price.

Studies have shown that the stock market responsiveness to unforeseen emergency is of short duration (cumulative decrease by 19.04% over 255 days in the case of Exxon Mobil Corporation)5.

Media reports also have direct impact on the share price. According to some data, the effect of positive news makes +0.58% and negative news result in −1.48%, according to the other, these figures are +0.63% and -0.82%, respectively5.

Relationships with borrowers directly affect the lending procedure. Thus, after a major environmental accident at the plant of United Carbide Company in India the enterprises of this company, located in different parts of the world, were transferred by the banking institutions to a higher interest rate as environmentally unreliable. As a result, United Carbide was on the verge of bankruptcy5. Relations with community are
important because they affect the possibility of carrying out work through public hearings.

Relationship with regulatory agencies may affect the company’s costs. For example, good relations with the supervisory authorities will allow obtaining permits faster.

- External effects (externalities) are costs that cannot be borne by the company directly. These costs are borne by the community. These include the depletion of nature caused by pollution which is normative under the current legislation. Externality costs are often estimated using the method of ‘willingness to pay’ of individual citizens. For example, if each additional unit of air pollution costs a person USD 10 required for further purification, health maintenance and other less obvious costs, then he will want to pay USD 10 to avoid an increase in pollution.

5. Conclusion

About 43 billion tons of production and consumption waste has been accumulated in Kazakhstan, of which only 5 percent undergoes recycling. With such an enormous amount of waste rubbish recycling facilities do not have enough raw materials for processing, because there is no culture of separate waste collection in the country. If they continue just to take waste to landfills or dumps, our descendants will have nowhere to build houses: lands tend to run out, and some kinds of the waste, for example, polyethylene, begin to decompose only after centuries.

The results of the conducted study suggest that any calculations based on a ‘willingness to pay’ method depend on a number of factors, in particular, on the level of personal well-being of the respondents.

To evaluate the external effects a surrogate approach can also be applied. Thus, for example, the amount of water used for any process may be represented as a cost of a reverse osmosis plant for saline water, so the cost of replacement by clean water will become a substitute of external effect[9].

In light of the above it can be concluded that a full assessment of the waste life cycle cost is a good addition to the standard of ecological and economic analysis carried out in the framework of environmental impact assessment (EIA) as it considers all stages of the waste life cycle, regardless of at what territory they are carried out within.

In the foreseeable future it is necessary to provide support for rubbish recycling companies at the expense of budget funds and, accordingly, to determine the purposes and manner how budgetary funds will be spent in the framework of waste management mission at rubbish recycling plants in the Republic of Kazakhstan.

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