

DEVELOPMENT OF A WASTE MANAGEMENT STRATEGY FOR TOURIST AREAS OF LAKE BAIKAL

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ABSTRACT: The Siberian Lake Baikal contains more than 20% of the world's fresh water supply. In addition to industry, tourism is the most important economical factor in the region. Olkhon Island is one of the most attractive tourist areas and has been chosen as a model. Currently, the lack of concepts for collection, transportation, recovery, and disposal of MSW causes uncontrolled dumping and negatively impacted landscapes. A German-Russian co-project for the "Development of a Waste Management Strategy for Tourist Areas of Lake Baikal" involves officials, university staff, enterprises and NGOs. The overall objective is to strengthen the economic basis for a sustainable development of the region, and to rehabilitate and conserve the ecological function of Lake Baikal. Steps for the implementation of the project and their corresponding results will be presented, like the assessment of the existing municipal waste management situation. A waste management strategy for Olkhon Island will be discussed.

1. INTRODUCTION

Lake Baikal, situated in Siberia, Russian Federation (Fig.1), is the deepest freshwater lake on the earth containing more than 20% of the world's fresh water supply. In December of 1996, the region of Lake Baikal was inscribed as a World Heritage Site by UNESCO.



Figure 1. Left: Russian Federation; Right: Lake Baikal and Olkhon Island

In addition to industry, tourism is the most important economical factor in the region. More than 100,000 tourists visit Lake Baikal annually with increasing tendency. Olkhon, the largest island in Lake Baikal (Fig. 2), is one of the most attractive tourist areas and has been chosen as a model representative for all other areas.

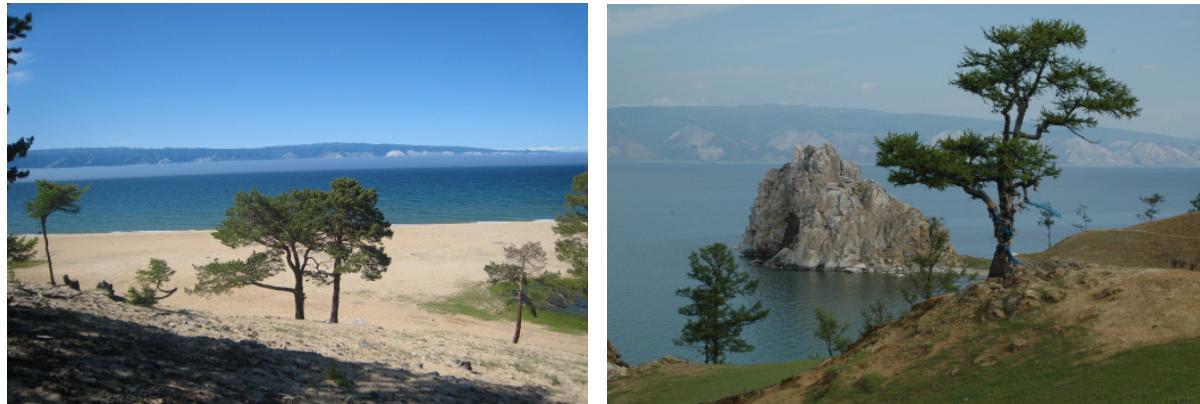


Figure 2. Impressions of Olkhon Island; Left: Saraysky Bay Beach; Right: Sacred Shaman Rock (Burkhan Cape)

Currently, a controlled disposal of municipal solid waste is not possible on the island Olkhon. The lack of concepts for collection, transportation, recovery, and disposal of municipal solid waste causes uncontrolled dumping. The population, consisting mostly of Buryats, believe that many places of Olkhon and the lake are sacred. Waste is therefore often secretly disposed of in the forests (Fig. 3).



Figure 3. Uncontrolled dumping sites in the forests of Olkhon Island

This results in incalculable environmental pollution of aerial, aquatic, and terrestrial systems. The environment pollution in turn causes health issues for the local population. The beautiful coasts, beaches and landscapes are negatively impacted by uncontrolled dumping of waste from illegal camping. A significant decrease in the number of visitors will lead to an economic collapse for the Buryats.

The Department of Waste Management Engineering at the University Duisburg-Essen prepared a German-Russian co-project for the “Development of a Waste Management Strategy for Tourist Areas of Lake Baikal” initiated by Dr. Olga Ulanova from the Technical University of Irkutsk (TU Irkutsk). Due to a high level of interest from the “German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety”, they help to fund this bilateral project regarding waste management in the region of Lake Baikal. The project receives support for the two years period of September 2006 through August 2008.

The aim of the presented project is to develop and implement an exemplary sustainable municipal waste management concept on Olkhon Island. This will be built in cooperation between the "Irkutsk Regions Department of Environmental Protection", "The Administration of the District Olkhon", "The TU Irkutsk" and the local NGO "Baikal Environmental Wave". The overall objective is to strengthen the economic basis for sustainable development of the region, and to rehabilitate and conserve the ecological function of Lake Baikal.

2. IMPLEMENTATION OF THE PROJECT

The implementation of the project is divided into successive tasks accompanied by public relation activities that will help to inform in addition to the broader public, governmental officials, university administration, and student body. A website (www.baikal-waste.eu) in German, Russian, and English serves to inform the stakeholders about the progress of the project and to disseminate best practices to as wide an audience as possible.

The project started with an initial meeting in October 2006 in Irkutsk and on Olkhon Island, serving for linking of contacts, coordination with partners, and presentation of the project schedule.

In the next step, a detailed examination of relevant federal and municipal Russian legislation, regarding recycling economy and guidelines for avoidance, recovery, and disposal of waste, was carried out. According to Russian law, the responsibility for waste management falls upon the individual communities, who also have jurisdiction in matters of recycling and landfilling. From this, it follows that the main township Chugier is in charge of waste management for Olkhon Island. Due to the fact that Olkhon Island belongs to the "Central Ecological Zone" of the "Natural Lake Baikal Area", additional laws regulate waste management. The community of Chugier must take care that waste is not disposed of uncontrolled. Disposal, recovery, and thermal treatment of waste are forbidden on the island, but temporary storage is allowed at declared places. Municipal solid waste must be collected and transported to a disposal site on the mainland.

In addition to the examination, an appraisal of Olkhon Island has been generated. Besides the investigation of the existing municipal solid waste situation, geologic, ecologic, and climatic data have been collected. Additionally social and economical conditions have been taken into account to guarantee that strategies to be developed are adapted to local conditions.

A small environmental laboratory has been installed at the TU Irkutsk in May 2007 for practical chemical and physical analysis of waste. Further, it facilitates the realization of internships, such as the International Ecological Summer School within the scope of the project.

The Summer School took place at the TU Irkutsk for lectures and seminars and on Olkhon Island for practical training. It was organized by both project partners. Within three weeks in June and July 2007 various students and members of the TU-Irkutsk, as well as representatives of the administration and local non-governmental organizations took part in the program. During the introductory session, the participants gained insight not only regarding German and Russian waste management technologies, but also on modern recycling techniques and waste management aspects of ecological tourism. In addition, there was an extensive overview of the environmental problems facing Lake Baikal from the perspective of the National Park and local environmental organizations. Presentations were complemented by extensive discussions, in which participants could exchange their experiences and thoughts about the problems facing the region.

Ten days of field work on Olkhon Island served to carry out a waste analysis to classify recyclable products and unusable waste. Students studying "Environmental Protection and Resource Conservation" in the Faculty for Chemistry and Metallurgy of the TU Irkutsk, as well as two students from the Sociology Department, took part in the program. A detailed description of the important investigation is given in chapter 3. While the tests were being conducted, a portion of the group, led by members of the Sociology Department, surveyed tourists, residents and the owners of camping grounds and hotels in an effort to observe amount, consistency, and disposal method of waste on the island. Separate questions were asked to evaluate environmental consciousness. The analysis of the surveys shed light on the mentality, cultural characteristics and environmental consciousness of the residents and tourists in regard to their handling of waste. The main conclusion of the survey was that

more than 80% of visitors to Olkhon find the island “dirty”, showing the urgency for action. The participants in the program learned not only scientific research methods, but also international teamwork. One of their important lessons was that science is of practical use to the environment.

In October of 2007, a round table discussion took place in the office of the Governor of the Irkutsk region. Representatives from the Administration, non-governmental organizations, companies and the project met for a two hour round of discussions about the state and outlook of the joint project after its first year and progress to date. The discussion was followed by an international workshop with over 40 participants. Presentations were given in waste management and disposal, sorting and recycling, landfilling and education within the scope of the program.

With aid of the collected experience a waste management strategy, presented in chapter 4, has been derived and must now be substantiated. A business plan will be drawn up based on the accomplished waste analysis. In conjunction with a market study, an estimation how much income would be generated through the sale of secondary raw materials (i.e. recycled goods) will be possible. The sale of such resources could considerably reduce the costs of collection, transportation, recycling and disposal of waste for both residents and tourists on Olkhon. The plan will serve as a basis for local strategies to be projected like scheduled collection, separation of organics, and its central composting as well as separate recovery of recyclables like glass, metal and plastics.

3. QUALITATIVE AND QUANTITATIVE ANALYSIS OF MUNICIPAL SOLID WASTE ON OLKHON

The qualitative and quantitative analysis of municipal solid waste shows whether, and to what extent recyclables are available. For a sound analysis a representative repeated collection of waste samples is necessary. After reaching an agreement with the Mayor of Chugier, the director of the local waste management company and the owners of the largest camping hotel on the island, random-sample analyses were conducted at the landfill, the uncontrolled dumping grounds and near the hotel. Through the sorting of waste, the tests determined the amount and proportional composition of residential waste. The results of the study serve as an important basis for the waste management strategy that is to be developed and allow for the assessment of various recycling options.

Conducting the tests required extensive preparatory work. All participants were equipped with safety gear including protective suits and masks, reinforced gloves, and shoes, and also received comprehensive safety training. In addition, the rest of the gear was brought to the island on a large truck. The directions for the field work and lab analysis were translated into Russian for the students.

3.1. Experimental

The average composition of municipal solid waste on Olkhon Island has been determined by sorting analysis of waste in a standardized procedure and in accordance with German Ordinance LAGA PN 98 (Länderarbeitsgemeinschaft Abfall 1998).



Figure 4. Waste analysis on Olkhon Island, Left: Screening; Right: Manual sorting

In this procedure, samples of fresh delivered waste have been premixed by opening each waste bag and shoveling. The mixed wastes were distributed on a clean surface to one layer coverage. After screening of the area in squares of 1 m², 25% of the fields (Fig. 4) were randomly chosen. The waste in these fields was sorted manually into the following 12 fractions: metals, hardplastics, textiles/shoes, wood, composites (mixed materials), paper/cardboard, cellulose, glass/mineral, plastic foils, organics (kitchen and green waste), and fine material. Wastes not belonging to the former mentioned fractions, were classified as "other". Wastes too small for manual sorting (< 40 mm) were classified as fine material and collected with a brush and dustpan. All fractions were weighed and their mass fraction was calculated in percentage terms.

3.2. Results

In Fig. 5 the average composition of municipal solid waste on Olkhon Island is presented. The high portion of inert, recyclable fractions is noticeable and clearly demonstrates the potential for recycling.

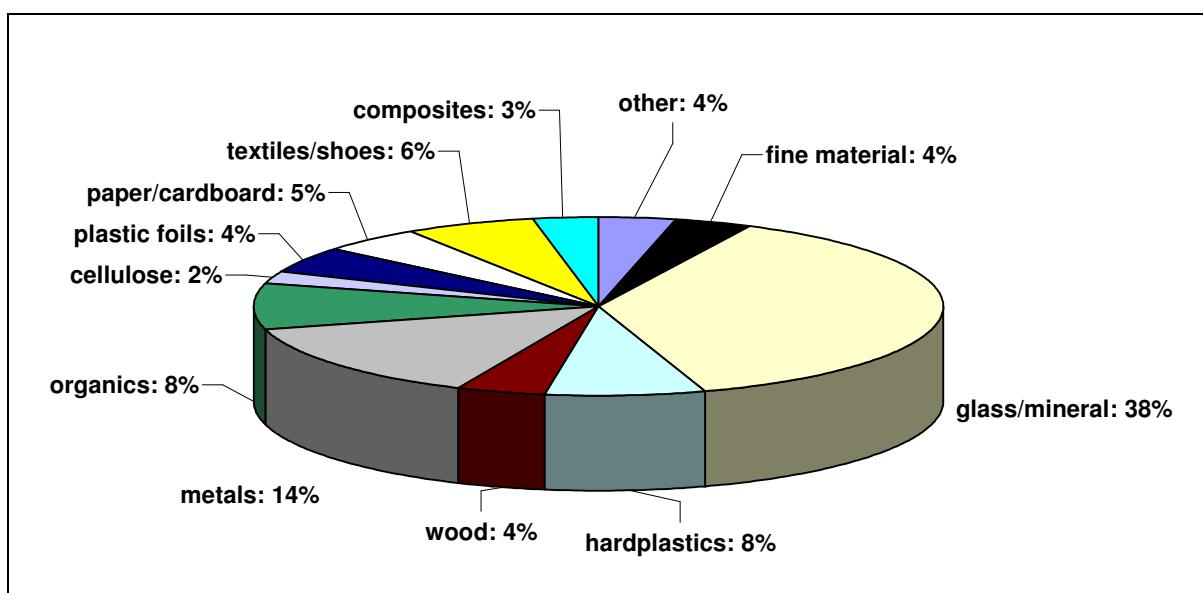


Figure 5. Average composition of municipal solid waste on Olkhon Island [mass%]

The main waste component is glass with 38%, followed by metals with 14%, and hardplastics with 8%. It is worth mentioning that the hardplastics fraction mostly consists of polyethylenterephthalat bottles, which when separately collected and colour sorted realize attractive market prices. The amount of waste to be disposed of will decrease by 60% with a recovery of these fractions.

At 8% and 5% respectively, organics and paper/cardboard are very low compared to German cities, where both fractions range from 20 - 30% in the municipal areas (Selic et al 2007). On Olkhon Island organics are feed to the animals, thus leading to a low amount of organics. The low percentage of paper and cardboard is caused by its use to ignite chimneys in households and even in hotels.

4. WASTE MANAGEMENT STRATEGY FOR OLKHON ISLAND

In Fig. 6 a waste management strategy for Olkhon Island is presented. Waste management always starts up with regulated collection and transport to waste treatment sites. Sufficient amounts of containers or collection points are required to collect municipal wastes as well as waste from tourists.

As mentioned before, the organic content of waste from Olkhon Island is very low. A simple drum sieve could serve to separate the organics from mostly inert residual waste. Separated organics may be composted or fermented during the short but warm summer season and its residues may be landfilled. Pre-treatment and inertization of biodegradable fractions from municipal solid wastes before

their disposal are important with respect to the environment and the reduction of green house gas emission.

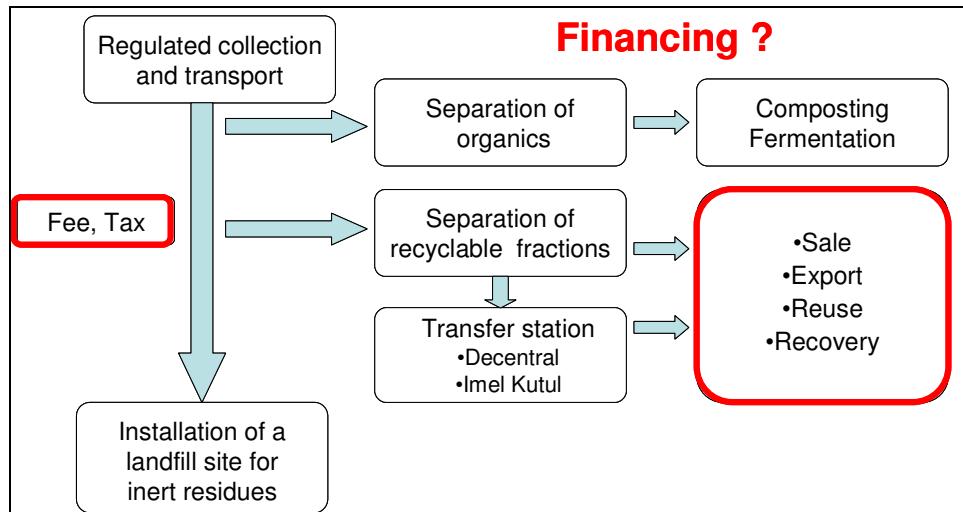


Figure 6. Waste management strategy for Olkhon Island

Separation of recyclables leads to reduced amounts of waste to be disposed of and an income by selling valuable fractions. Whether these fractions are sold within the region, or exported to other countries, depends on actual market conditions. Reuse and recovery serve to save raw materials and its costs. Nevertheless, this income will not be enough to finance sustainable waste management but will reduce tax and fees being necessary.

To obtain high market prices, and to optimize logistics, valuable fractions must be collected to optimal amounts. A transfer station serves for separation and storage. Whether this station is located decentred on the island or centred on the mainland to treat the islands waste together with wastes from other regions, depends on the amounts of collected waste. Up to now, waste amounts of Olkhon Island are not sufficient to guarantee feasible decentred separation. At present, the installation of a transfer station and necessary separation techniques on a planned landfill site near to the village Imel Kutul on the mainland seem to be the optimal solution. In 2007, the administration made 1.5 million rubles available for the planning of the new landfill. All trash from Olkhon and the coastal region of Maloe More (small sea) will be disposed of there.

Current main interests are to take care that Imel Kutul will not simply be an additional dumping ground. Suitable technology for the treatment of municipal solid waste, according to European standards, must be evaluated. Various options for financial strategies will be derived based on the business plan in development. Social, cultural, and psychological aspects will be considered in the effort to obtain a sustainable local waste management strategy which may be transferred to regions with similar conditions.

5. CONCLUSION

The project presented is a type of consultative aid that through surveys and waste analysis could suggest possible solutions to a larger problem. The implementation of these solutions, however, must be carried out on site with the support of the administration of the Irkutsk region, and even central government in Moscow.

To ensure a comprehensive solution an interdisciplinary team must cooperate. Municipalities, governments, policy makers and local NGO's must be integrated to guarantee that the activities comply with all relevant regulations within the local and regional context, and to make people willing to continue the process by their own. The methods to be established must be cost-effective, easy to operate, and of low maintenance to enable operators to continue the implemented strategies without further foreign help.

Linking contacts to investors and private companies as possible co-financiers for design and construction of pilot plants has to be an ongoing process. Nevertheless, a sustainable waste management strategy starts with household awareness that waste is too valuable for disposal.

Education and dissemination activities are necessary both on university level and on practical teaching of local persons in particular children. In spring of 2008 pupils of Olkhon Island will be educated in environmental protection and conservation. At the end of June 2008 again practical teaching on Olkhon Island for students from Irkutsk and this year from Germany too, will be organized. It is planned that students demonstrate separate collection, and inform the tourists about sustainable waste management. The intention is learning by doing.

Communication strategies will be developed to inform local inhabitants, and to increase the acceptance of waste management measures. Public Relations like flyers, brochures, and the website will ensure that best practices out of the project are disseminated to a wide audience.

A successful strategy will relieve the environment. In turn, this will increase tourism and local economies. This ecological-economical cycle will help to improve and stabilize living conditions for the entire region. With additional financial support from federal Russian budgets or private investors, the successful introduction of a simple but effective municipal waste collecting and treatment concept will be possible.

6. ACKNOWLEDGEMENT

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