

## **EXPERIENCE OF BIOTOILET INSTALLATIONS ON KIZHI ISLAND, REPUBLIC OF KARELIA, RUSSIA**

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### **Abstract**

In 1992-2004, Northern Water Problems Institute of the Russian Academy of Science and North Savo Regional Environment Centre implemented the project “Development of water supply in Republic of Karelia”. Research was carried out within several subprojects, one of which was a project on Kizhi Island in co-operation with the State Historical, Architectural and Ethnographic Reserve-Museum.

Given that Kizhi Island is situated in Lake Onego, implementation of the project aimed to improve environmental situation on the island is also topical, as it would reduce point-source impact on surrounding waters.

The project idea for Kizhi Island was to establish a model area – environmentally clean territory of the reserve-museum within the natural landscape, away from large settlements. It was presumed there existed all possibilities to adapt European experience of applying environment-friendly technologies to Russian social and natural settings.

As the result of the project 2 biotoilets were constructed on the island and the equipment exported from Finland was installed.

The Kizhi Reserve-Museum Administration continues to take much action to improve environmental situation not only in the museum territory itself but also in nearby settlements.

**Keywords:** Kizhi Island, Lake Onego, tourists, ground waters, biotoilets

## **Republic of Karelia and Northern Water Problems Institute**

Republic of Karelia is situated in the northwest of European Russia, between 61° and 67° N (ca. 650-km north-to-south stretch) and between 30° and 38° E (max west-to-east stretch ca. 400 km). The area is 172,400 km<sup>2</sup> if waters of Lakes Ladoga and Onego within Karelian territory are included, or 155,900 km<sup>2</sup> otherwise [1].

The combined action of a number of factors, including geographic position, climate, geological structure and others, has generated a well developed drainage network belonging to the White Sea and Baltic Sea watersheds. The White Sea watershed covers 57% of the republic (water areas of Lakes Ladoga and Onego excluded) and 43% of the territory of Karelia belong to the Baltic Sea watershed. The drainage network is mainly composed either of small rivers, or of short channels which connect numerous lakes to form lake-river systems.

The total number of rivers known today (Karelian Isthmus included) is 26,700. Their combined length is 83,000 km. Watercourses shorter than 10 km prevail. There are 25,300 of those (95%) with a combined length of 52,300 km (63%). Only 30 rivers are longer than 100 km, thus belonging to the medium-size class. Watersheds of an overwhelming majority of rivers are also small in area. Only 366 water systems have watersheds larger than 100 km<sup>2</sup>, including 51 systems with a watershed larger than 1000 km<sup>2</sup> and 5 watersheds larger than 10000 km<sup>2</sup> (rivers Kem, Vyg, Kovda, Vodla, Shuja).

The main structural elements of the drainage network in Karelia are water bodies (lakes and impoundments). There is a total of 61,100 lakes with a combined area of ca. 18,000 km<sup>2</sup> in the republic. About 50% of the water area of Lake Ladoga and 80% of Lake Onego – the largest bodies of freshwater in Europe – fall within Karelian territory. Lakes cover 12% of the territory. If Karelian parts of Lakes Onego and Ladoga are included, the proportion rises to 21%, which is one of the highest in the world. Most lakes are less than 1 km<sup>2</sup> in area. Only 1389 water-bodies have a larger area (slightly more than 2% of the total), and only 20 of these are larger than 100 km<sup>2</sup>. The prevalent type of small water-bodies is lakes with no visible discharge (“drainless”), represented mainly by small forest and mire lakes (lampi).

The Northern Water Problems Institute is the academic research structure conducting scientific investigations of the aquatic environment in Northwest Russia for 60 years already. It was established as the Department of Water Problems in the Karelian Branch of the USSR Academy of Science in 1946. In 1991, it was re-organized into the Northern Water Problems Institute that belongs to the Karelian Research Centre, Russian Academy of Science.

The basic research areas of the institute are:

- Natural development of the lake-river systems and ground waters located in Northwest Russia, study of their stability and variability with regard to climatic and anthropogenic factors.
- Scientific assessment of the status and forecast of changes in water ecosystems; development of measures for nature conservation and restoration.
- Assessment of water ecological potential; development of the scientific basis for sustainable management of water resources in the North of European Russia.
- Optimization of use, conservation and restoration of water resources in Karelia.
- Theory of lake-river and sea systems development.
- Water resources in relation to population vitality.

NWPI is active in the implementation of new methods and technologies in water systems investigations. Dissemination of the results obtained during surveys and comprehensive analysis is crucial for social purposes such as the improvement of the drinking water supply, sanitary-ecological situation in the settlements and training highly

environmentally qualified specialists working for sustainable development of the region in different fields of activity. NWPI conducts the active environmental educational program with the publication of got scientific information adapted to the wide audience [2, 3, 4, 5, 6].

Because of the fact that 43% of the territory of Karelia belongs to Baltic Sea watershed, anthropogenic activity in almost a half of the territory influences the Baltic Sea condition. That is why the environmental education especially for the administrative official is essential for sustainable development of Karelia and well-being of the Baltic Sea watershed in general.

NWPI maintains a wide range of international scientific cooperation.

### **Project “Development of water supply in Republic of Karelia”**

In 1992-2004, Northern Water Problems Institute of the Russian Academy of Science and North Savo Regional Environment Centre implemented the project “Development of water supply in Republic of Karelia”. Using the results of prospecting and appraisal of groundwater deposits in sand-gravel sediments carried out during the project, plans of water supply were produced for Republic of Karelia in general and for a specific area, the Kizhi Island in that number (pic 1).



Research was carried out within several subprojects, one of which was a project on Kizhi Island. The Museum Administration became involved in it from the very beginning. State Historical, Architectural and Ethnographic Reserve-Museum Kizhi is situated in Medvezhjegorsky District, Republic of Karelia. It was founded in 1966 through a resolution of the Soviet Union Government. Architectural monuments in the museum, especially the Transfiguration Cathedral, are unique masterpieces of Russian wooden architecture. In 1990, UNESCO included the Kizhi Pogost ensemble in the World Heritage List. The Kizhi Island has long been known far beyond Russian borders. Today, it is a centre of global tourism. Tourist traffic in 2008 was over 195 000 people, in that number foreign people more than 100 000 (pic. 2.)



Given that Kizhi Island is situated in Lake Onego (pic.3), implementation of the project aimed to improve environmental situation on the island is also topical, as it would reduce point-source impact on surrounding waters. The project intended to handle pollution problems on the island by trying out up-to-date methods of waste handling in the museum buffer zone. In 1999, prospecting and appraisal surveys were carried out in the museum territory. Using the results thereof, an uptake well was built to serve as the basis for follow-up of the project for water supply on the island. However, water supply issues are closely related to environment pollution, specifically pollution of the groundwater catchment area. One of the possible solutions is construction of facilities for collection and disposal of domestic wastes, as well as biotoilets.



The project idea for Kizhi Island was to establish a model area – environmentally clean territory of the reserve-museum within the natural landscape, away from large settlements. It was presumed there existed all possibilities to adapt European experience of applying environment-friendly technologies to Russian social and natural settings. Given that Kizhi Island is very popular among tourists from both Russia and abroad (pic. 4), there are good chances for wide dissemination of the project experience.



The first stage of the project was preliminary analysis of the area to determine its unique characteristics, number of tourists, and to choose the place for locating biotoilets to meet esthetic requirements and natural settings of the museum. After that 2 biotoilets were constructed on the island and the equipment exported from Finland was installed (pic. 5). Before the facility was put into operation, the staff responsible both for environment protection in the museum territory and for maintenance of the structures was trained in the methods of biotoilet maintenance.



## Conclusions

One should note in conclusion that although the large project that had launched it all in 1992 is over, the Kizhi Reserve-Museum Administration continues to take much action to improve environmental situation not only in the museum territory itself but also in nearby settlements. In 2008, the museum began actively working in the new pilot project “Enhancement of environmental situation in settlements of Karelia” with participation of the Northern Water Problems Institute and initiated by the Global Dry Toilet Association of Finland. By now, preliminary surveys were carried out within this project in the villages of Yamki and Kukuevo situated 1 km and 2.5 km away from the Kizhi museum territory, respectively. Also, one is considering the possibility of building dry toilets in settlements in the museum buffer zone, within a 5 km radius, where some architectural monuments are situated, and public festivities organized by the museum take place.

Local people, who had the chance to get familiar with the “dry biotoilet” method in the museum territory, actively support the project implementation. Thus, following a request from local people, and to disseminate project experience, one of the toilets was transported to the village of Kukuevo.

The project team is hopeful about its full-scope implementation in the nearest future and dissemination of good experience through wide-reaching awareness-building work.

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