

MERCURY RISK ASSESSMENT FROM A WASTEWATER STORAGE POND IN PAVLODAR CITY, NORTHERN KAZAKHSTAN

Mikhail Ilyushchenko¹, Paul Randall², Trevor Tanton³, **Alexander Ubaskin**⁴, Grigoriy Uskov¹

¹ Almaty Institute of Power Engineering and Telecommunication, 126 Baytursynov str. Almaty, 050013 Kazakhstan, Tel.: +7 727 2929814, Fax: +7 727 2924461, E-mail mai@aipet.kz

² U.S. EPA National Risk Management Research Laboratory, 26 W. Martin Luther King Drive, Cincinnati, OH 45268 USA, Tel: 513-569-7673, Fax: 513-569-7105, E-mail randall.paul@epa.gov

³ School of Civil Engineering & the Environment, University of Southampton, Highfield, Southampton, SO17 1BJ, UK, E-mail t.w.tanton@soton.ac.uk

⁴ Pavlodar State University, 64 Lomov Str., Pavlodar, 140000, Kazakhstan, Tel.: +7 7182 450454, Fax: +7 7182 451196, E-mail awupawl@mail.ru

A wastewater storage pond located in the Northern Industrial Area of the city of Pavlodar was constructed at the place of the natural saline Lake Balkyldak 5 km far to the east from the Irtysh River floodplain. The storage pond capacity is 74 millions m³; water-surface area – 18 km², and evaporation efficiency – 11.4 millions m³ per year at a critical level mark of 110.8 m. Maximal depth of the storage pond is 10 m. The storage pond operation has been started since 1971 without construction of any environmental protective objects there. At present the pond has been confined from two sides (west and east ones) with two protective solid earth-fill dams 8425 m long and from three side (west, north and east ones) – with clay impervious barrier so called cut-off wall 10 557 m long, 0.6 m wide and 2.5 – 6.0 m deep reaching the basalt clay layer. According to balance calculation more than 10 tons of mercury have been released to the storage pond together with wastewater of Pavlodar PO “Khimprom” running chlor-alkali production with mercury electrolysis in 1975-1993.



Figure 1. Wastewater storage pond Balkyldak south shore

After the plant decommissioning in 1995 only about 1 million m³ of wastewater per year are discharged to the storage pond however its level does not drop lower than 110.0 m mark. The water body is recharged by groundwater fed in turn by an ash lagoon of two heat power plants located 2 km far to the south from the lagoon. Offshore strip of the storage pond is covered with reeds with the area of 2.6 km² (fig.1). Several species of non predatory fish (generally silver

crucian carp) inhabit the storage pond, which are the objects of intensive sport fishing for humans living in Pavlodar city outskirts despite danger warning and prohibitions.



*Figure 2. Bottom sediment sampling from the depth of 9 m.
Wastewater storage pond Balkyldak, March 2006*

The researches (Fig.2) of 2000-2008 allowed producing a map of the storage pond bottom sediments mercury contamination (maximal mercury concentration is 1 g/kg), calculating amount of mercury there (135.3 tons), determining aquatic organisms mercury contamination level (mercury concentration in fish is up to 2.5 mg/kg), finding dependence of spread of technogenic sediments across the bottom of this not deep water body on waving activity on its surface as well as dependence of mercury content in surface water (maximal total mercury concentration in water is 350 ng/L and maximal dissolved mercury concentration - 10 ng/L) on amount of suspended solids there. Also a map of soil mercury contamination within the territory between the storage pond and the plant has been produced. Within the framework of demercurization of the former chlor-alkali production the containment of mercury sludge lagoons located on the shore of the wastewater storage pond has been conducted.

In case of dredging, capping or at least consolidation of mercury contaminated bottom sediments of the storage pond it can be used as a source of clean fresh technical water (for example for the heat power plant or metallurgical works located in the vicinity). With a view to health risk minimization for communities living in the vicinity of the wastewater storage pond the issue of possibility of destruction of mercury contaminated fish inhabiting the technical water body using some ichthyological poisons is being discussed.

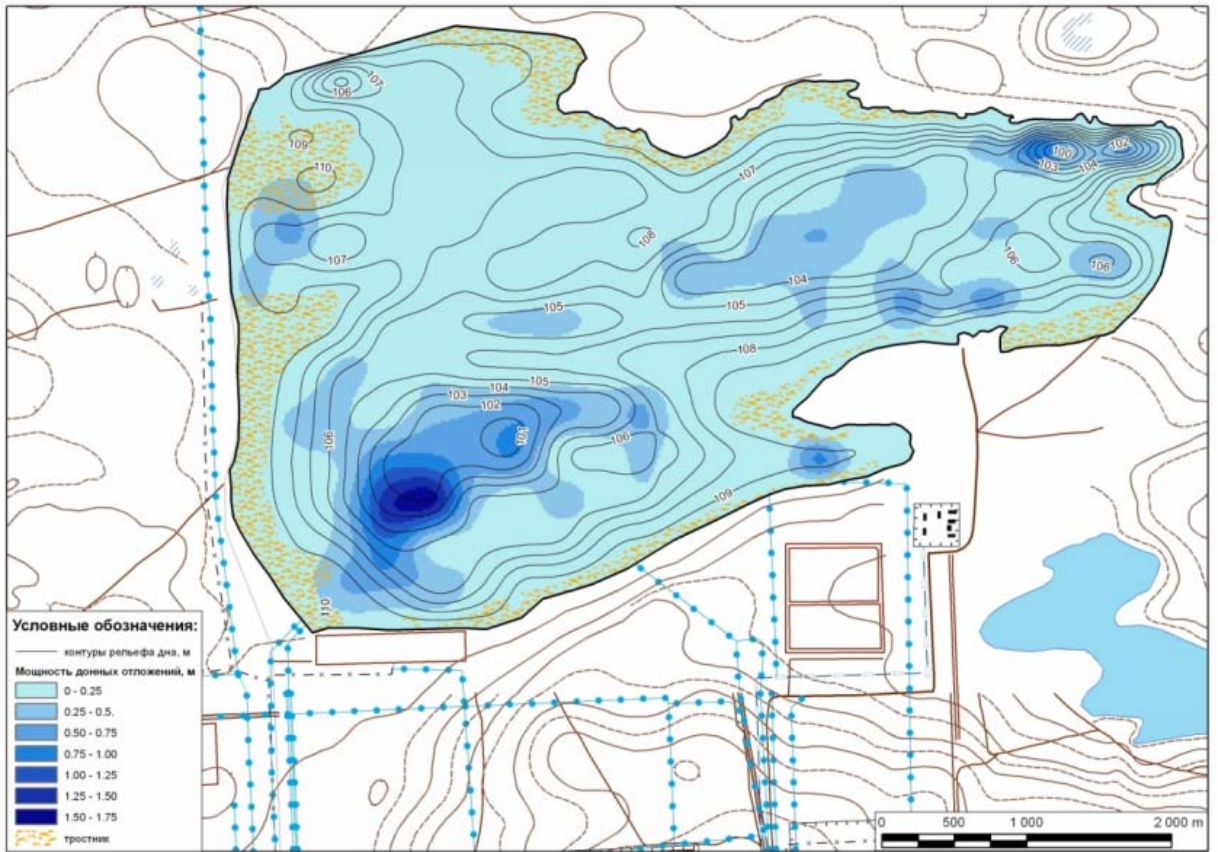


Figure 3. Wastewater storage pond Bakyldak bathymetric map and bottom sediments thickness

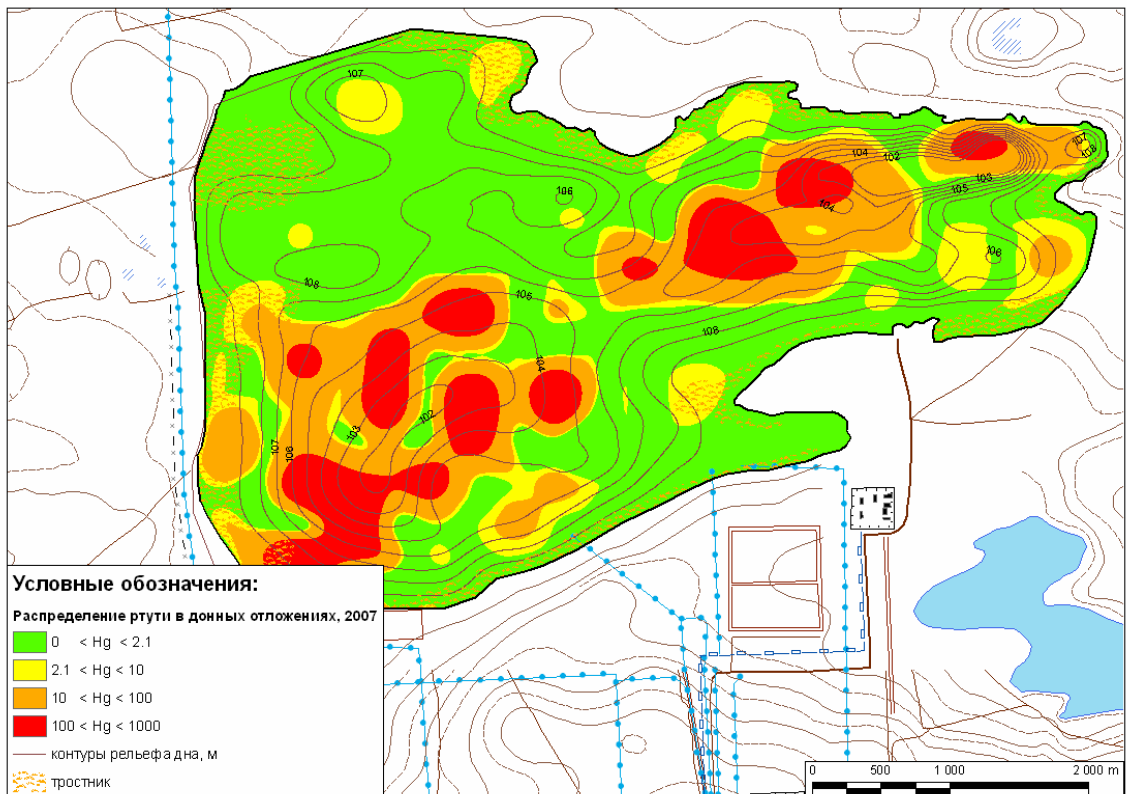


Figure 4. Wastewater storage pond Bakyldak bottom sediments

ACKNOWLEDGEMENTS

The work was financially supported by International Science and Technology Center (ISTC project # K-1240p).