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Environmental Assessment of a Coastal Transport Terminal in the Azov Sea

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Abstract

The documentation of the methanol (toxic technical spirit) coastal transport terminal was presented voluntary to Russian Federal Ecological Expert Council for official ecological expertise in the end of 1997. This terminal will be build at the coast of Taganrog Bay (Azov Sea) by "Azovproduct" Ltd. in co-operation with Italian transport company. In the frame of the expertise author has rewired the correction of prediction of pollution of seawater by the actual terminal operation. The environmental importance of the problem is related with high level of toxicity of methanol, the great value of suggested transportation by middle tankers, and due the potential danger of terminal operation for important fishing resources in Taganrog Bay area.

The done work shows that existing normative methods are not enough for correct estimation of the environmental risks in actual situations. In the same time, the reporting of the possible environmental impact of the future activity of terminal is required by governmental environmental control institutions.

To improve the existing approach, two principal scenarios of environmental impact have been designed and analysed. The first one is the spill of methanol from coast to near-coastal waters due the discharge from inland storage tanks, from locations of processing/disposing facility, and after collapse of structures or other terminal facility. The second design case is the spreading of methanol spot in Taganrog Bay after rupture of a methanol tanker by prevailing currents in the area of accident.

It is assumed that in the second scenario the mass of the instantaneous methanol spill into water from the destroyed storage tanks of tanker equals 500 tons of mass. The propagation of the discharged spot is resulted by wind current field generated in the Taganrog Bay. This bay is relatively narrow, about few kilometres width, and about 30 km long. So, the wind current in the bay is generated by winds, which blow in offshore directions, as well as along the bay axis. To predict wind generated currents the nonstationary geophysical boundary layer numerical model is applied. The result of modelling show that under design wind (in the range 5-20 m/s, various directions) the velocities of the wind-generated current are evaluated from 0.095 to 0.318 m/s (velocities of surface layer). It is important that due a shore effect the wind current can turn it's direction even under wind, which blows along the longitudinal axis of bay.

The numerical study of vertical profile of wind current shows that the modelling must based on 3D model of pollutant convection-diffusion. The special rates show also that the Don River flow in the bay is negligible usually due the very complicated topography of Don delta.

To simulate the propagation of the methanol spot, the 3-D modelling is applied with including of evaporation process to the mass balance equation. Jointly with numerical modelling, analytical 2-D solutions are applied, and comparison of the numerical and analytical results shows the limitations of 2-D approach. It is obtained the methanol concentration evolution during the time of methanol spot reaching shore, and longshore concentration distribution. After expertise, it is recommend to owners of coastal terminal to develop the estimation of potential damage and to design the protective measures. Moreover, the general structure of the guidelines "Prediction of Environmental Risks for Coastal Transport Terminal of Toxic Liquid Substances" for environmental risks assessment for similar situation is designed and presented to the Russian Ministry of Natural Resources as project of the future standard.