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The Dnieper River Aquatic System Radioactive Contamination; Long-tern Natural Attenuation And Remediation History

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Near 27 year passed after the Chernobyl Accident, and the experience gained to study radionuclide behavior in the aquatic systems and to mitigate water contamination are still pose of interest for scientists, society and regulatory austerities. There are different aspects of radionuclide transport in the environment were studied since the Chernobyl fallout in 1986 covered the river catchments, wetlands, river, lakes/reservoirs and reached the Black Sea. The monitoring time series data set and also data on the radionuclides behavior studies in the water bodies (river, lakes and the Black Sea) are available now in Ukraine and other affected countries. Its causation analyses, considering the main geochemical, physical and chemical and hydrological process, governing by radionuclide mobility and transport on the way from the initially contaminated catchments, through the river-reservoir hydrological system to the Black Sea can help in better understanding of the main factors governing be the radionuclide behavior in the environment.

Radionuclide washout and its hydrological transport are determined speciation of radionuclides as well as soil types and hydrological mode and also geochemistry and landscape conditions at the affected areas. Mobility and bioavailability of radionuclides are determined by ratio of radionuclide chemical forms in fallout and site-specific environmental characteristics determining rates of leaching, fixation/remobilization as well as sorption-desorption of mobile fraction (its solid-liquid distribution). In many cases the natural attenuation processes governing by the above mentioned processes supported by water flow transportation and sedimentation played the key role in self-rehabilitation of the aquatic ecosystems. The models developed during post-Chernobyl decade and process parameters studies can help in monitoring and remediation programs planed for Fukusima Daichi affected watersheds areas as well. Some most important monitoring data collection results and experience gained during post-Chernobyl decades at the Dnieper River aquatic system are presented (catchments, river and reservoirs). This experience show that only information on radionuclide deposition levels is not enough for accurate predictions on radionuclide wash-out and transport in the hydrological systems. Data on speciation in fallout, rates of transformation processes and site-specific environmental characteristics determining these rates are needed. Information on radionuclide chemical forms, their transformation in other words mobility and bioavailability should be taken into account when rehabilitation and decontamination strategies are developed on local or regional scale. Number of inadequate water protection measures carried out during initial post-accidental period took place because lack of preparedness, data and decision making support tools were in use, Environmental radiation monitoring network has not been developed and huge impact of social stressing and inadequate risk perception took place. Many experimental data, models developed and experience for safe management at the contaminated watersheds and water bodies can be useful and in particular those, who dealing with consequences of Fucusima accident 2011. The paper gives extended overview and describes experience of authors in justification and evaluation of the remedial actions applied after Chernobyl accident with focus on most important lessons learned and potentially utilized in future.