



Uranium contamination of the Aral Sea

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The Aral Sea is known to the wider public as an inland water body that experiences dramatic shrinkage in water volume since the 1960's due to water abstraction for intensive irrigation from the two main inflowing rivers the Syrdarja (Jaxartes) and the Amudarja (Oxus) which is intensified by the arid climate in the region. Why should one consider contamination of the Aral Sea with radionuclides? Own investigations on radionuclides in the Aral Sea are combined with the results of a monitoring study for radionuclides in Central Asian transboundary rivers, the NAVRUZ experiment.....(Barber et al. 2005), which identified sources of natural radionuclides and metals in the watershed of the Aral Sea and analysed their distribution in water, soil and biomass along the river courses. Many uranium ore deposits in the water shed of the Syrdarja, along with intensive mining and ore processing (Karatau ridge, Shyily, Mailuu Suu) cause contamination of the river water with radionuclides. The relative high mineralization of the Syrdarja River water, e.g. of 1 g L^{-1} at Mailybas near the Aral Sea, keeps uranium and some of its decay products dissolved in the water, and thus river water enriched in uranium ($16.7\ \mu\text{g L}^{-1}$) is discharged into the Aral Sea. This is well above the proposed WHO guideline for drinking water of about $2\ \mu\text{g L}^{-1}$. For comparison, the world average uranium concentration in surface water is $0.5 - 1\ \mu\text{g L}^{-1}$. Uranium is known to be nephrotoxic in mammals including humans. In addition, groundwater extrusions at the base of the Ustyurt Plateau transport uranium from cretaceous sedimentary deposits and upper Oligocene sediments in the northern Ustyurt that contain sulfide-phosphorus deposits enriched in uranium and rare metals into the Aral Sea. Within the lake water, the concentration of uranium in the water increases as desiccation proceeds. A linear increase of uranium in the water with salinity was found. In the western basin of the Aral Sea, uranium is 8-fold increased with respect to Syrdarja water. The high ion strength of the water seems to affect the redox chemistry of uranium. Therefore, the elevated concentrations of U in river water,

ground water and Aral Sea water should be of environmental concern.

The working hypothesis of this study is that the main source of Uranium in the endorheic Aral Sea is the inflowing river water, and the desiccation leads to accumulation of uranium in the water column that reach ecotoxicologically critical levels as a result. To our knowledge, no previous studies exist on the contamination of the Aral Sea itself with radionuclides. The aim of the study is to look at the pathways of uranium in the Aral Sea. In this way our study ties in with the already mentioned radionuclide monitoring study in Central Asian Rivers.

.Barber, D. S., Betsill, J. D., Mohagheghi, A. H., Passell, H. D., Yuldashev, B., Salikhbaev, U., Djuraev, A., Vasiliev, I. & Solodukhin, V. 2005. The Navruz experiment: Cooperative monitoring for radionuclides and metals in Central Asia transboundary rivers. *Journal of Radioanalytical and Nuclear Chemistry* **263**(1), 213-218.