

## Ensuring safe use of water in a river basin with uranium drainage

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A regular radioactivity monitoring programme ensures radioactivity surveillance in a river system with multiple and intensive uses of water. In the catchment of River Mondego, centre of Portugal, there is a uranium mining and milling legacy which encompasses about 12 old uranium mine sites and 3 uranium milling sites. This river basin is an important agriculture and cattle growing region with forest areas for paper pulp production. In the catchment of this River there are four dams for electricity production and two main artificial lakes which are water reservoirs to supply drinking water to more than 3 million people, and irrigation water for agriculture including maize and rice production. In the river basin, environmental remediation works were recently implemented especially at the milling tailings and at the major mine sites, which reduced radioactive drainage into the Mondego tributaries and thus into the Mondego river. Mine drainage and seepage from tailings are recuperated and treated in mine water treatment stations. Although, for example, in drainage from milling tailings at Urgeiriça, water may contain high concentrations of dissolved uranium ( $^{238}\text{U}$ ), radium ( $^{226}\text{Ra}$ ) and polonium ( $^{210}\text{Po}$ ) at  $35700\pm 1100$ ,  $1084\pm 30$ , and  $700\pm 40$  mBq/L, respectively, in the stream receiving discharges of treated water today radionuclide concentrations are orders of magnitude lower. The tributary streams that in the past received untreated mine discharges are today recovering and concentrations decreased to near natural levels. In the artificial lake of Aguieira dam, built on the Mondego River downstream all uranium sites, and where the main capture of water for human consumption is located, radionuclide concentrations were of  $9.2\pm 0.3$  mBq/L,  $17.7\pm 1.9$  mBq/L, and  $5.3\pm 0.2$  mBq/L for uranium ( $^{238}\text{U}$ ), radium ( $^{226}\text{Ra}$ ) and polonium ( $^{210}\text{Po}$ ), respectively. This water has been over the last years consistently in compliance with the EU drinking water quality standards, and radioactivity levels are comparable to natural levels of other rivers with no uranium mines. Furthermore, water quality allows for use of these lakes as fishing and swimming grounds.

**Author:** Prof. CARVALHO, Fernando P. (Instituto Superior Técnico/Laboratório de Protecção e Segurança Radiológica, E.N. 10, Bobadela LRS, Portugal)

**Co-authors:** Mr OLIVEIRA, J.M. (Instituto Superior Técnico/Laboratório de Protecção e Segurança Radiológica); Ms MALTA, M. (Instituto Superior Técnico/Laboratório de Protecção e Segurança Radiológica)

**Presenter:** Prof. CARVALHO, Fernando P. (Instituto Superior Técnico/Laboratório de Protecção e Segurança Radiológica, E.N. 10, Bobadela LRS, Portugal)

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