

Water Resources Monitoring, Mine Water Control and Treatment in Portuguese Legacy Uranium Mines

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Environmental rehabilitation of old abandoned mines in Portugal has been done since 2001 by EDM - Empresa de Desenvolvimento Mineiro, a state-owned company, including radioactive and polymetallic mines. By 2018, remediation of 103 mining areas has been completed out of a total of 199 and 7 are with ongoing remediation works. In regard to radioactive mines 40 of a total of 62 have been remediated and 6 are with ongoing remediation works. Surface and groundwater monitoring and mine water control and treatment are a relevant activity in the remediation work developed in radioactive mines. These monitoring activities began in 2002. This includes measuring *in situ* parameters and laboratory analysis of chemical and radiological parameters as total uranium, radium-226, sulphates, chlorides, manganese, calcium and sodium. These elements were identified in previous studies as the best indicators of hydrogeochemical contamination related to the old uranium mining areas. The water resources monitoring plan covers upstream and downstream surface water samples, groundwater samples through wells, boreholes and piezometers in the surrounding mine area, together with the quality control of mine water before and after treatment. Annually, a total of around 1260 water samples are collected in 62 radioactive mines. Some details and example results of the work performed by EDM regarding the water resources monitoring plan and control of mine water effluents implemented in the radioactive mines will be presented. One of the main focus of these remediation design projects is the control and treatment of mine water using passive treatment systems. EDM is implementing these types of systems with demonstrated success, in some cases associated with natural groundwater attenuation processes for uranium, radium-226 and other metals.