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Methodology for the characterization of historical waste

Portugal is a western European nation with 10.6 M inhabitants (approx.). Uranium ore extraction ceased in 2000 and all former U exploration sites have been or are presently being remediated, as there are no further plans to resume this activity. There are no nuclear power plants in the country. The radioactive waste (RW) generated consists mainly of materials from past U and Ra mining and milling activities, spent and/or disused sealed radioactive sources, smoke detectors, lightning rods, contaminated scrap metal, depleted U from aircraft counterweights, materials contaminated with unsealed sources produced from the applications of ionizing radiation in the fields of Medicine, Industry and Research.

Instituto Superior Técnico (IST) the School of Engineering of the University of Lisboa operated a 1 MW pool-type research reactor since the 1960s, at its Campus Tecnológico e Nuclear. The research reactor was shutdown in 2016 and irradiated spent fuel shipped to the USA in 2019 in the framework of a MoU between Portugal, USA and IAEA. At the same Campus, the Radiation Protection and Safety Laboratory of IST also operates since 1960 the only radioactive waste storage facility of Portugal, a surface type facility dedicated to the storage of very low and low level waste (VLLW, LLW) as well as small amounts of intermediate level waste (ILW).

Following the publication of Decree-Law n. 156/2013, of November 5th, that transposes the European Council Directive 2011/70/EURATOM, IST prepares an inventory of the RW stored at its facility and submits to the Regulator annually. Records registered after the year 2000 are reliable but there is a strong uncertainty relative to the waste collected before, considered as legacy waste that requires characterization and classification.

Clearance and exclusion levels as set by the European Council Directive 2013/59/Euratom (and General Safety Requirements Part 3) were adopted by the Portuguese legislation as Ministerial Order n. 44/2015 presently superseded by Ministerial Order n. 138/2019.

A first National Programme for the Management of Spent Fuel and Radioactive Waste (2015-2019) was approved by the Government and published in the official journal, following the strategic environmental assessment and public consultation. More recently in 2022, a second Programme was published.

The Programme specifically considers the characterization and identification of legacy waste, the eventual preparation of clearance processes and the improvement of the overall inventory of radioactive waste. The operating license was recently renovated in 2021 and also mentions these objectives.

IST is motivated to perform these tasks and prepared a methodology for the characterization of the legacy waste stored in 220 l drums that will be presented in this work. The methodology consists mainly on the assessment of the environmental dose equivalent rates (at contact and at 1 m distance), activity concentration measurements by gamma spectroscopy for gamma emitters and wipe tests analysis by liquid scintillation counting for alpha and beta emitters. Identified materials will be segregated and compressed aiming at volume reduction. Based on the physical quantities assessed with the characterization the corresponding waste classification and/or clearance procedures will follow for approval by the Regulator.

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