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Strategies for reducing the waste generated from medical radioisotope production: towards a sustainable future.

GORDON J THOROGOOD[1], ANATOLY ROZENFELD[2] AND ROBERT RAPOSIO[1]

[1]ANSTO
[2]University of Wollongong
Presenting Author: gjt@ansto.gov.au

Currently the nuclear industry is at a crossroads due to growing concerns for environmental, social and governance (ESG) which require change in the form of lower carbon emissions for electricity generation.

One often overlooked aspect of nuclear waste is the fact that current fission-based production methods of the medical radioisotope ^{99}Mo use targets that are based on high output without taking into consideration the amount of radioactive waste produced. Ensuring continuous supply of ^{99}Mo to the world is an extremely complex achievement involving target manufacturers, irradiators, processors, the radiopharmaceutical industry, governments, and organisations. To facilitate continuous supply producers are encouraged to overproduce and some of the challenges affecting the supply is the fact that current manufacturers use aged facilities, the transition from HEU to LEU is not as economical for producers, and the challenges of alternative technologies being developed due to economic and technical hurdles and the difficulties with transport of enriched uranium, and the current cost structure means that ^{99}Mo is uneconomical without government subsidies. It is estimated that approximately 5 times as much radioactive waste is produced using LEU instead of HEU targets with a corresponding five times less ^{99}Mo produced by these targets [1].

We examine the idea of using low enriched target (<20%) to reduce the amount of nuclear and chemical wastes produced by the manufacture of ^{99}Mo via fission of uranium-based targets and how this process will not only reduce waste but ensure that the waste produced can be easily handled.

[1] Hassan, M., Ryu, H. J. (2015) Radioactive waste issues related to production of fission-based ^{99}Mo by using low enriched uranium (LEU), Journal of Nuclear Fuel Cycle and Waste Technology, Volume 13, Number 2, Pages 155-161.