

## Potential for lithium-lead re-utilisation in fusion power plants

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Eutectic lithium-lead (LiPb) is one of the tritium generating materials being considered in current European blanket studies. Its re-utilisation during several maintenance cycles has the potential to considerably reduce the amount of activated material arising from the operation of fusion power plants based on those concepts, and would consequently help reduce costs. There are two limits to the continual re-utilisation of the LiPb: (a) generation of permanent disposal waste (PDW), and (b) depletion of lithium and reduction of the tritium generation rate to a level at which self-sufficiency is not achieved and off-site supply is required. Analyses performed for the Power Plant Conceptual Study (PPCS) already explored the first issue, although only to the extent necessary for its purposes, i.e. only for one blanket/divertor cycle of irradiation. Moreover, these analyses did not take into account the complex irradiation history of LiPb flowing through plant structures with variable neutron flux levels and energy spectra.

Based on the blankets, power plant designs and neutron transport analyses of the PPCS, this paper addresses those issues and presents estimates of the radiological hazard of LiPb irradiated in the blanket or divertor of these plants during several cycles, made using the FISPACT code. Tritium self-sufficiency is also discussed, and calculations reported here point to the need of occasional lithium replenishment during the plant's lifetime, although not as frequently as every cycle. Given that regardless of the number of re-utilisations no PDW is generated, provided that compositional optimisation is ensured, the possibility of using the same LiPb during the entire life of the plant is demonstrated.