We present a design study for a wearable radiation-shielding spacesuit, designed to protect astronauts' most radiosensitive organs.For an average 50% dose reduction to BFO this is equal to about 2.5 tons of Al. Overall, our results offer a proof- of-principle validation of a complementary personal shielding strategy in emergency situations in case of a SPETo quantify shielding performance we use GRAS/Geant4 simulations of an anthropomorphic phantom in an average SPE environment, with and without the spacesuit, and we compare results for the dose to Blood Forming Organs (BFO) in Gy-Eq, i.e. physical ab- sorbed dose multiplied by the proton Relative Biological Effectiveness (RBE) for non-cancer effects.In case of SPE occurrence for Intra-Vehicular Activities (IVA) outside a radiation shelter, dose reductions to BFO in the range of 44-57% are demonstrated to be achievable with the spacesuit designs made only of water elements, or of multi-layer protection elements (with a thin layer of a high density material covering the water filled volume).In this work, selection of materials for the spacesuit elements is performed based on the results of dedicated GRAS/Geant4 1- dimensional Monte Carlo simulations, and after a trade-off analysis between shielding performance and avail- ability of resources in the space habitat.Different designs and material combinations are proposed for the spacesuits.