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Promoting Safety, Sustainability, and Innovation: Responsible Utilization of Radioactive Waste and By-products for a Circular Economy

Integration of safety, sustainability, and innovation has become a critical imperative in today's world. This ideology is closely linked to the responsible utilisation of radioactive waste, decommissioning, and environmental protection. However, this does not only involve waste generated during the decommissioning of nuclear power plants but also by-products from other energy sectors like fly ash originating from coal and biofuel combustion, which can sometimes be contaminated with radionuclides like ^{137}Cs . Research shows that the implementation of fly ash as a partial cement replacement can divert it from traditional waste streams, reduce airborne emissions and demand for virgin materials as well as improve the structural integrity of the materials manufactured with such by-products. This idea can be further expanded to include the reuse of cementitious materials left over after the decommissioning of nuclear power plants for various civil engineering purposes. The potential applications could be radioactive waste immobilization, road construction or the manufacturing of reinforced concrete sleepers. When handled and implemented appropriately, such utilisation of radioactive materials would not pose considerable risk to human health or the environment. In conclusion, while fostering innovation, such utilization practices would also promote sustainable industrialization as well as the stride towards the circular economy.

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