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Water Treatment Technologies for Radionuclide Removal©

Treatment Technology	Radionuclide Contaminant	EPA Treatment Designation	Source Water Efficacy	Operator Training Level	Treatment Considerations
Ion Exchange (cation, anion, mixed bed)	Radium (cation), uranium (anion), Gross Alpha (<i>c.f.</i> Radium, uranium), Gross Beta (mixed bed)	BAT/SSCT	Ground Water	Intermediate	Regenerate disposal, competing ions (sulfate, calcium), chromatographic peaking
Reverse Osmosis	Effective for all radionuclides, 99% removal (also arsenic)	BAT/SSCT	Surface Water Ground Water (small CWS)	Advanced	Disposal, pre-treatment, membrane scaling and failure
Lime Softening	Effective for all radionuclides	BAT/SSCT	All Waters	Advanced	Disposal, pre-treatment, low contaminant reductions
Enhanced Coagulation/filtration	Uranium, Gross Alpha, Gross Beta	BAT/SSCT	All Waters	Advanced	PH must exceed 10.6 for radium removal Complex monitoring
Greensand Filtration	Radium (small systems)	SSCT	All Waters	Basic	Low pH, Fe, Mn limit efficacy
Barium Sulfate co-precipitation	Radium	SSCT	Suitable ground water chemistry	Advanced	Too complex for small systems
Electro Dialysis/ Electro Dialysis reversal	Radium, Uranium, Gross Alpha, Gross Beta	SSCT (radium only)	All Ground Waters	Intermediate	High operating and disposal costs
Pre-formed Hydrous Manganese Oxide Filtration	Radium (also removes arsenic)	SSCT	All Ground Waters	Advanced	Competing ions (Fe, Mn)
Activated Alumina	Uranium	SSCT	All Ground Waters	Advanced	pH sensitive, disposal
Point-of-use POU RO Point-of-entry POE ion exchange	See Reverse Osmosis, Ion Exchange above	SSCT	Surface Water, Ground Water	Basic	In home treatment (see RO- above)
Iron based adsorptive media	Radium, Uranium, Gross Alpha (also arsenic)	None: Relatively new technology	Surface Water, Ground Water	Basic	Contaminant break-through. Monitor spent medium, low-cost benefit