

Index

A

Absorbed dose, 301–302
Absorption, 94
Adsorption, 94
Air dose rates, remediation effect, 264–268
Air kerma rate constant, 303
Algae, 96, 97
Aluminosilicates, 226, 227
Ambient dose equivalent, 305
Ameliorants, 113
 application, 151–154
 biological mobility, 152–154
 mineral and organic fertilizers, 150
 physicochemical properties, 151–152
Aminopolycarboxylic acid, 188
Anthropogenic radionuclides, IWF, 236–238
Arbuscular mycorrhizal fungi (AMF), 190, 191
As low as reasonably achievable (ALARA), 308
Atmospheric tests, 273
Atomic power engineering, 65

B

Bacteria, 98–99
Bioaccumulation, 178, 179, 187, 202
Bioaccumulation coefficient (BC), 15, 206
Bioaugmentation, 176
Biochar
 accumulation, 127
 agriculture, 116–117
 agrochemical analysis, 119
 agrochemical properties, 116
 ameliorative properties, 134
 bergmeal, 118, 126, 130, 131
 bokashi, 118, 125, 128, 129

cesium-selective sorbents, 114
characteristics
 carbon, 114
 graphite, 115
 macro-elements, 115
 magnesium, 115
 microelements, 115
 microstructure, 115
 organic compounds, 115
 organic heterocycles, 115
 phenoxides, 115
 phosphorus, sulfur and nitrogen, 115
Chernobyl accident, 114
composts, 117
experimental soil mixture, 118
fossils, 113
fuel and energy resources, 113
mangold, 120, 124
measurement activity concentration, ¹³⁷Cs,
 119–120
mechanisms, 134
pollutants, 114
pyrolysis processing, 114
root absorption, 113
soil ameliorants
 agrochemical indicators, 122–124
 mangold, 124–126
 peat soil, 127–131
 physical and chemical forms, ¹³⁷Cs,
 131–134
 soil-improving additives, 119
 valuable soil ameliorant, 113
 vegetative experiment, 118
Bioconcentration factors (BCF), 183
Biodiesel, 113

- Biogas, 113
- Biological effects, radiation exposure, 309–310
- Biological treatment methods, 3
- Biological wastewater treatments, 95
- Biominalisation, 178, 179, 181
- Bioremediation, 164–170, 178–179, 201–203
- AMF, 190, 191
 - anthropogenic environmental contamination, 163
 - applications, 182–191
 - artificial/technogenic radionuclides, 163
 - bio- and phytoremediation, 164
 - Chernobyl nuclear power plant disaster, 163
 - contaminated soils, 174–182
 - conventional strategies, 192
 - cost effective process, 175, 176
 - depleted uranium, 173
 - genetics and genome-level characteristics, 192
 - IAEA, 193
 - in situ vs. ex situ, 176
 - laboratorial conditions, 192
 - laboratory experiments, 185
 - in medicine, 174
 - mesocosm systems, 192
 - natural attenuation, 177
 - nuclear disasters, 170–171
 - nuclear fuel cycle (*see* Nuclear fuel cycle)
 - nuclear test sites, 171–172
 - nuclear weapons, 163
 - physicochemical characteristics, 164
 - vs. physico-chemical remediation, 177–178
 - phytoextraction, 188–190
 - and phytoremediation, 201–203
 - poly-metal decontamination, 182
 - radionuclides (*see* Radionuclides)
 - uranium mines, 166
- Biosorbents, *see* Biosorption
- Biosorption, 7
- algae, 96
 - bacteria, 98–99
 - biomass/adsorbents, 95
 - factors, 95–96
 - fungi and yeast, 96–97
 - plants, 96
 - polymeric substances, 95
 - solid and liquid phases, 95
- Biostimulation, 176
- Bremsstrahlung, 299
- Brookhaven National Laboratory (BNL), 211
- C**
- Carbamide, 227
- Carbon-encapsulated magnetic nanoparticles (CEMNPs), 102
- Carbon nanomaterials (CNM), 103
- Carbon nanotubes (CNTs), 103
- Cartridge filters, 4
- Catastrophic radiation accidents, 223
- Cation exchange capacity (CEC), 143
- Cesium and strontium, 53
- Cesium-134 (^{134}Cs), 215, 260–262
- Cesium-137 (^{137}Cs), 260–262
- ability of plant species, 208
 - Chernobyl fallouts, 207
 - hydroponic experiments, 207
 - Kochia scoparia*, 214
 - phytoremediation, 209
 - rhizospheric mobilization, 207
 - soil contamination, 207
 - and ^{90}Sr , 210
- Cesium sorption, 54
- Cesium transfer decreasing factors, 62
- Chemical pollutants, 95
- Chemical vapour deposition (CVD), 103
- Chemisorbents, *see* Chemisorption
- Chemisorption
- chemical-conjugate absorbent, 100
 - graphite based chemical adsorbents, 100
 - natural and industrial effluents, 100
- Chernobyl disaster, 51, 114, 144, 165, 170, 180, 204, 224, 234
- Chernobyl's nuclear power plant accident, 183
- Clay aquifuges, 248
- Coal ash slag (CAS), 186
- Collective water filters (CWF), 230, 232, 233
- Colorado River, 8
- Committed effective dose, 305
- Committed equivalent dose, 304
- Comparative tests, 230
- life test of IWF, 236–238
 - natural radionuclides, 238–239
- Competitive sorption
- a priori* estimation, 66
 - aqueous electrolyte solution, 86
 - chromatographic equipment, 87
 - countermeasures, 66
 - decontamination, 65, 67
 - diffusion-kinetic mode, 87
 - extractant, 86
 - flow-type reactor, 86
 - heterogeneous equilibria, 67
 - ion-exchange desorption, 66
 - kinetics
 - analytic solution, 77
 - degree of reversibility, 80
 - diffusion-controlled sorption, 77
 - direct and inverse reaction constants, 79
 - equilibrium desorption, 75
 - equilibrium system, 77

- exponential factors, 79
 - inflection point, 80
 - iron-potassium cyanoferrate, 75
 - linear adsorption mechanism, 77
 - mini-reactors, 76
 - non-equilibrium decontamination coefficient, 77–79
 - polyethylene test tubes, 80
 - relaxation time values, 77
 - silica gel powder, 80
 - ultra-diluted solution, 77
 - material, 69
 - microbe strains and phyto-sorbents, 66
 - mini-reactors, 86
 - multiphase and multicomponent system, 66
 - potassium fertilizers, 65
 - radionuclides, 65
 - relaxation time values, 88
 - RIP, 66
 - self-sustaining process, 88
 - soil deactivation technologies, 66
 - sorbents, 66, 86
 - sorption-active clay fraction, 65
 - statics
 - acceptable strategy, 73
 - complexing agent solutions, 72
 - convenience of analysis, 72
 - convenient phase separation method, 72
 - decontamination coefficient, 71, 72
 - desorption efficiency growth, 72
 - electrolyte, 69, 74
 - equilibrium competitive system, 69
 - exchange center types, 74
 - heterogeneous equilibrium, 70
 - homogeneous reaction, 70
 - hydromica microcrystals, 74
 - isotherm, 70, 73
 - liquid desorbing substance and sorbent, 73
 - microelement, 67, 69, 70
 - microelement sorption equilibrium, 72
 - nonselective exchange centers, 74
 - PB and soil solution, 74
 - polyantimonous acid, 75
 - potassium/ammonium ions, 74
 - soils, 74
 - Sr(II) ions, 75
 - thermodynamic equilibrium, 67
 - thermodynamic estimation, 69
 - Compton scattering, 296, 297
 - Constituents of concern (COC), 3
 - Crystalline FB-2 filters, 238
- D**
- Daylight surface, radionuclide carry-over by plants, 280–282
 - Deactivation
 - characteristics, soils and grounds, 251
 - distribution coefficients of cesium, 252
 - drinking water
 - CWF, 230, 232, 233
 - filters life test, 233–236
 - IWF, 230, 232, 233
 - large-scale, 240
 - radionuclides, 230
 - liquid and dry methods, 247
 - LRW, 247–248
 - radioactive matter, 246
 - solid radioactive waste, 248–250
 - solutions, 246
 - Decontamination Pilot Project, 259
 - Deflation processes, 277
 - Dehydroascorbate reductase (DHAR), 191
 - Depleted uranium (DU), 173
 - Desorbing electrolytes, 248
 - Deterministic effects, 309
 - Diethylenetriaminopentaacetic acid (DTPA), 188
 - 5-Dimethyl-phenylenedene (DDPD), 100
 - Directional dose equivalent, 306
 - Dose equivalent rate, 301, 303–304
 - Dose of medicine, 301
 - Dose of radiation, 301
 - Dosimetric quantities and units
 - absorbed dose, 301–302
 - exposure, 300–301
 - kerma, 302, 303
 - radiation protection quantities, 300
 - Drinking water decontamination, 230–240
 - activation products, 229
 - deactivation (*see* Deactivation, drinking water)
 - fissionable materials, 229
 - fission products, 229
 - maximal permissible activities, 230, 231
 - temporary permissible levels, 230
- E**
- East Urals Radioactive Trace (EURT), 171
 - EDR distribution, 286
 - Effective dose, 305
 - Electric double layer, 34
 - Electrokinetic decontamination, 39
 - Electrokinetic fences, 42
 - Electrokinetic method of deactivation, 248

- Electrokinetic remediation, 11–12, 32, 33
 acid and alkaline fronts, 35
 advantages, 33
 ammonium ion, 41
 contamination, 36
 electrode compartment, 40
 electrokinetic removal, 36–39
 electromigration, 40
 pilot scale and field applications, 41–42
 potassium nitrate, 41
 principle, 32
 radionuclides, 39–41
 scale and field applications, 41–42
 soil flushing/washing, 39
 transport mechanisms, 33
- Electrokinetic removal, 36–39
- Electromigration, 34, 35
- Electroosmosis, 33
- Electro-osmotic flow, 35
- Elementary competitive system, 88
- Eluent deactivation, 247
- Energy fluence rate, 295
- Environmental decision support system (EDSS), 18
- Equivalent dose, 304
- Equivalent dose rate (EDR), 277, 278
- Estimating deflation processes, soil cover, 279–280
- Estimating processes, overgrowing with vegetation, 277
- Ethylenediamine disuccinate (EDDS), 188
- Ethylene-diamine-tetraacetic acid (EDTA), 189
- Exposure, 300, 301
 radiation source, 306–308
 rate, 301, 303
- Ex-situ deactivation, 247, 248
- Extracellular polymeric substances (EPS), 180
- F**
- Ferrocyanide ions, 58
- Ferrocyanide sorbents, 54, 58
- Ferrocyanides leaching, 59
- Filling with clean soil, 285–286
- Filters
 comparative tests, 236–239
 life test, 233–236
 sanitary qualifying, 239, 240
 and spent sorbent, 253–254
- Fluence, 294
- Fluence rate, 295
- Frayed edge sites (FES), 141
- Fresh water
 clinoptilolite, 228
 equilibrium distribution coefficients, 227–229
 sorption properties, 227
- FSUE “Radon”, 254
- Fukushima Daiichi accident, 144, 168, 224
- Fukushima Daiichi nuclear power plant (FDNPP), 10, 183, 259
- Fukushima-1 nuclear power plant, 248
- Fungi, 96–98
- G**
- Geobacter*, 8
- GeoMelt-ISV project, 13, 14
- Groundwater, 8
- H**
- Half-value layer (HVL), 297
- Harmful tissue reactions, 309
- Henry’s law, 67, 70, 77, 81
- Heteropolyacids (HPAs), 100
- Hexafluoride, 166
- High-energy photons transfer, 298
- High-level radioactive waste (HLW), 223
- High Purity Germanium (HPGe) gamma spectroscopy, 260
- Humic acids (*HA*)
 acid-base properties, 82
 adsorption regularities, 81
 ANOVA techniques, 83
 energy inhomogeneity, 83
 geochemical systems, 81
 humate solution, 85
 Langmuir isotherm, 82
 logarithmical form, 84
 strontium ion sorption, 84, 85
 thermal/chemical treatment, 82
- Hydrosol™ solution, 210
- Hydrous ferric oxide (HFO), 102
- Hydrous manganese oxide (HMO), 102
- Hygienic norms, 57
- Hyperaccumulators, 184, 202, 217
- I**
- Indirectly ionizing radiation, 297
- Individual water filters (IWF), 227, 230, 232, 233, 239
- In-situ deactivation, 247
- In situ leaching (ISL), 164

In situ remediation's technologies, 11
 In situ soil flushing, 43
 In situ vitrification (ISV), 12
 Intensive Contamination Survey Areas (ICSAs), 259
 Interaction of radiation with matter
 absorption of radiation energy, 295
 attenuation, 295, 296
 biological effects, 295
 bremsstrahlung, 299
 charged particles, 295, 298, 299
 Compton scattering, 296, 297
 directly ionizing radiation, 298
 electron loses, 299
 energy loss, 299
 high-energy photons transfer, 298
 HVL, 297
 interaction coefficients, 297, 298
 ionization, 299
 LET, 298
 neutrons, 297
 photoelectric effect, 296
 positron-electron pair, 297
 range, 295, 296
 secondary charged particles, 298
 specific ionization, 299
 threshold energy, 297
 uncharged particles, 295, 296
 X-ray and gamma, 296
 Intermediate Level Radioactive Waste (ILRW), 44
 International Atomic Energy Agency (IAEA), 1, 168, 246
 International Commission on Radiation Units and Measurements (ICRU), 292
 International Commission on Radiological Protection (ICRP), 292
 International Energy Agency (IEA), 166
 International Nuclear and Radiological Event Scale (INES), 309
 Ion pair, 299
 Isomorphous substitution, 141
 ISV equipment, 13
 IWF-1, 232
 IWF-2, 232
 IWF-3, 232
 IWF-4, 232
 IWF-5, 232
 IWF-6, 232
 IWF-7, 233
 IWF-8, 233
 IWF-9, 233
 IWF-10, 233

J

Japan Atomic Energy Agency (JAEA), 259

K

K-channel, 122
 Kerma, 302, 303
 Kinetic Energy Released per unit Mass, 302
 Kyshtym accident, 143

L

Laboratory-scale experiments, 11
 Langmuir equation, 67
 Langmuir theory, 66
 Large-scale deactivation, drinking water, 240
 Least square method, 85
 Life test of IWF
 anthropogenic radionuclides, 236–238
 count rate, 235
 decontamination factors, 236
 loading spiked and non-spiked water, 234, 235
 measurement, 233
 NPF-C and KU-2, 235
 permissible activities of radionuclides, 234
 principles of radioactive tracer's method, 234
 protection shield, 234
 before treatment, 234
 value of retention volume, 233
 values of counting coefficients, 235
 Liming, 149, 150
 Linear energy transfer (LET), 298
 Linear stopping power (S_l), 298
 Liquid radioactive waste (LRW), 247–249, 251, 253, 255
 Logarithmic Langmuir equation, 81
 Low-level LRW, 248
 Low Level Nuclear Waste (LLNW), 186

M

Maghemite, 102
 Magnetically assisted chemical separation (MACS), 102
 Manganese oxides (MnOs), 101
 Mangold, 120, 121, 124–126
 Mass attenuation coefficient (μ/ρ), 297
 Mass energy absorption coefficients (μ_{en}/ρ), 297
 Mass energy transfer coefficients (μ_{tr}/ρ), 297
 Mass stopping power (S_m), 298

- Mathcad 14 program, 78
- Mathematical modelling approaches
- acetate biostimulation, 19
 - EDSS, 18
 - EXPURT model, 21
 - factors, 17
 - hydrogeochemical modelling, 20
 - kinetic and equilibrium models, 21
 - software based models, 16
 - STRATEGY project, 17
- Mean mass depth, 262
- Mean residual dose rate factors, 269
- Measured activity depth profiles, 268–270
- Mechanical remediation of radiocesium
- air dose rates, 264–268
 - costs and benefits, 260
 - ^{134}Cs , 260–262
 - ^{137}Cs , 260–262
 - farms, schoolyards, gardens, parks, 263
 - FDNPP, 259
 - JAEA, 259
 - measured activity depth profiles, 268–270
 - strategies, 263
 - topsoil mixing, 263
 - topsoil stripping, 260, 263, 264
 - total cost, 263
- Metal sulfide ion exchangers (MSIEs), 100
- Metal wastes, 93–94, 104
- Microbial bioreduction, 6–9
- anaerobic microbial communities, 6
 - bacterial electron transport, 9
 - decontamination test process, 10
- Mill tailings, 5
- Mineral composition, 60
- Ministry of Education, Culture, Sports, Science and Technology (MEXT), 260
- Ministry of the Environment (MoE), 259
- Mixed Waste Management Facility (MWMF), 212
- Monodehydroascorbate (MDHAR), 191
- Monte Carlo radiation transport, 264
- Monticello Mill, 5
- Montmorillonite clays, 154
- Multi-walled carbon nanotubes (MWCNTs), 103
- N**
- Nanomaterial
- aqueous systems, 101
 - bioremediation approaches, 101
 - CNM, 103
 - Fe and Fe^0 , 102
 - functions, 101
 - maghemite, 102
 - Mn and Zr, 101–102
 - nano-sorbents, 101
 - Ti, MgO and ZnO nanoparticles, 103
- Nano-remediation, 104
- Nanoscaled zero valent iron (NZVI), 102
- Nanosorption, 101
- Nanotechnology, 101
- National Nuclear Center of the Republic of Kazakhstan, 284
- Natural radionuclides, 238–239
- Natural water bodies
- advantages, 227
 - aluminosilicates, 226, 227
 - fresh water, 227–228
 - seawater, 229
 - sorbents, 226
 - sorption, 226
 - surface-modified sorbents, 226
 - thin-layer modification method, 227
 - TLIS, 226, 227
- Naturally occurred radioactive materials (NORMs), 163, 225
- Nevada Test Site, 172
- N-(hydroxyethyl)-ethylenediaminetriacetic acid (HEDTA) trisodium salt, 190
- Nickel oxide, 103
- Nickel-potassium ferrocyanides (NPF), 52
- Nitrogen fertilizers, 146
- N,N-disalicylidene-4, 100
- Nonwoven filtering materials, 226
- Novaya Zemlya test site, 172
- Nuclear Energy Agency (NEA), 166
- Nuclear explosions in atmosphere, 273
- Nuclear fuel cycle
- nuclear fuel reprocessing, 169–170
 - nuclear power plants, 167–169
 - uranium fuel fabrication, 166–167
 - uranium mining and milling, 164–166
 - waste repositories, 169–170
- Nuclear Non-Proliferation Treaty (NPT), 172
- Nuclear power plants (NPPs), 167
- Nuclear Regulation Authority (NRA), 260
- Nuclear weapon tests, 223, 224, 248
- O**
- Old Rifle processing site, 8
- Operational quantities, 305
- Organic RW, 249
- Oxidize dehydroascorbate (DHA), 191

P

Pacific Northwest Laboratory (PNL), 12
 Passive dosimeters, 310
 Permeable treatment wall (PTW), 4
 Personal dose equivalent, 306
 Phosphate fertilizers, 148
 Photoelectric effect, 296
 Physicochemical methods

- electrokinetic remediation, 32
- electro-osmotic flow, 34
- on-site soil remediation technologies, 32
- soil washing and incineration, 32
- solid/liquid wastes, 31
- technologies, 32

 Phytoaccumulation, 14
 Phytoextraction, 14

- arbuscular mycorrhizal fungi, 188
- Brassica juncea*, 189
- chelating agents, 189
- CO₂ levels, 190
- concentrations of Cs, 189
- description, 205
- fertilization, 189
- phytoaccumulation, 205–209
- radionuclides, 188, 189
- rizhosphere, 188
- schematic representation, 206
- soil microbial community, 188
- U-citric acids complexes, 190

 Phytomining, 182
 Phytoremediation, 14–16, 104

- applications, 204–213
- bioremediation, 201–203
- ¹³⁷Cs, 209
- Cs contaminated soils, 213–215
- ³H, 212
- history, 203–204
- phase of, 218
- plants, 218
- radionuclides, 208, 217–218
- soil remediation techniques, 219
- Sr, Tc and Cl contaminated soils, 216–217
- U contaminated soils, 216

 Phytostabilization, 182, 183, 190, 191

- description, 205
- radionuclides, 212, 213
- schematic representation, 206

 Phytovolatilization, 182

- description, 205
- plant's ability, 211, 212
- schematic representation, 206

 Polyethylene terephthalate (NTFM), 226
 Polypropylene membranes (MP), 226

Portland cement, 45
 Positron-electron pair, 297
 Potassium fertilizers, 147
 Prussian blue (PB), 74
 PTW performance monitoring system, 5

R

Radiation accidents, 245, 248, 249
 Radiation dose limits, 308, 312
 Radiation exposure, 292, 300, 308–310, 312
 Radiation field, 294, 295
 Radiation measurements and monitoring, 310–311
 Radiation protection, 303–308

- average annual population exposure, 291, 292
- biological effects of radiation exposure, 309–310
- dose limits, 308
- dosimetric quantities and units, 300–303
- interaction, 295–300
- measurements and monitoring, 310–311
- principals, 311–313
- quantities (*see* Radiation quantities)
- radiation field, 294, 295
- radioactive contamination, 291
- radioactive releases, 291
- radioactive sources, 292–294
- radiological compliance criteria, 292
- remediation actions, 292
- site characterisation, 292

 Radiation quantities

- assessment
 - external exposure, 305, 306
 - internal exposure, 306
- committed effective dose, 305
- committed equivalent dose, 304
- dose equivalent rate, 303–304
- effective dose, 305
- equivalent dose, 304
- ICRP, 303
- radiation source, 306–308

 Radiation sensors, 310
 Radiation source, 306–308
 Radiation weighting factors, 304–306
 Radioactive biological waste, 254, 255
 Radioactive contamination, 36, 201, 204

- caesium levels, 157
- ¹³⁷Cs, 139
- landscapes, 51
- sod-podzolic soils, 147
- territory, 157

- Radioactive fallouts, 223
 - Radioactively contaminated lands, *see*
 - Radioactive waste (RW)
 - Radioactively contaminated water, *see* Water decontamination
 - Radioactive sources, 303
 - activity, 293
 - amount of radioactive material, 293
 - characterization, 292
 - count statistics, 294
 - emission rate, 294
 - mass activity concentration (a_m), 293
 - measurement, 294
 - point sources, 293
 - surface activity concentration (a_s), 293
 - volume activity concentration (a_v), 293
 - Radioactive tracer's method, 234
 - Radioactive waste management, 312
 - Radioactive waste (RAW), 10, 93–94, 246, 288
 - deactivation (*see* Deactivation)
 - disposal, 255
 - IAEA, 246
 - rehabilitation method, 246
 - treatment (*see* Treatment of RW)
 - Radiocesium, 186, 213–215, 259
 - See also* Mechanical remediation of radiocesium
 - Radiocesium gamma rays, 263
 - Radiocesium interception potential (RIP), 54, 66
 - Radiological warfare agents, 274
 - Radiometric parameters, 277, 278
 - Radionuclide carry-over by plants
 - daylight surface, 280–282
 - evaluating, 276
 - Radionuclides, 36, 229
 - activity concentration, 277–279
 - americium, 250
 - bacteria and fungi, 179
 - beta emitting, 255
 - catastrophic radiation accidents, 223
 - cesium, 252
 - concentrations, 225
 - from contaminated soils and ground, 250
 - dissolving and desorbing, 247
 - drinking water (*see* Drinking water decontamination)
 - durability of fixation, 246
 - elimination, 250
 - hydrolyzable, 251
 - ions, 248
 - leaching, 252, 254, 255
 - LRW, 255
 - mechanisms, 178
 - and metals, 178
 - microbial transformation and immobilization, 179–182
 - migration, 248
 - natural waters, 225
 - natural waters with salt content, 226–229
 - and radioactive aerosols, 224
 - separation, 251
 - short-lived, 223
 - storage of spent sorbents, 253
 - strontium, 254
 - volatile, 254
 - water migrating, 224
 - Radiostrotrium, 206
 - Reagent deactivation, 250
 - Regular Exchange Sites (RES), 141
 - Rehabilitation, 246
 - activities, 245–246
 - measures, 288
 - radioactively contaminated land, 286
 - RW (*see* Radioactive waste (RW))
 - Remediation, 104, 273
 - overgrowing with vegetation, 282
 - STS (*see* Semipalatinsk test site (STS))
 - Residual dose rate factors, 264–267
 - Residues of nuclear activities (RONA), 285
 - Rhizofiltration
 - description, 205
 - plant roots, 209, 210
 - schematic representation, 206
 - Rifle site, 8
- S**
- Salt composition, 54
 - Sanitary qualifying of filters, 239, 240
 - Savannah River Site (SRS), 211
 - Seawater decontamination, 229
 - Self-Assembled Monolayers on Mesoporous Supports (SAMMS), 101
 - Semipalatinsk test site (STS), 224, 249, 274–283
 - atmospheric tests, 273
 - nuclear testing, 273
 - plowing (*see* Soil plowing)
 - radiation hazardous, 274
 - research, 274
 - soil rehabilitation, 274
 - storage of removed soil, 274
 - territory, 286–288
 - underground nuclear tests, 273
 - Shubert method, 83

- Siderophores, 178
- Single-walled carbon nanotubes (SWCNTs), 103
- Sod-podzolic soil
 - cation exchange capacity, 152
 - characteristics, 146
 - dry meadow, 157
 - field experiments, 149, 150
 - humus, 149
 - organic fertilizers, 150
 - soil solution, 147
 - ^{90}Sr , 152
- Soil-based remedial options, 143
- Soil cover, deflation processes, 279–280
- Soil layer interchange, 263, 264, 266, 268, 270
- Soil mixing, 264, 270
- Soil plowing
 - choice of remediation technology, 275
 - deflation processes, 277
 - estimating deflation processes, 279–280
 - filling with clean soil, 285–286
 - ground by plowing soil, 282–283
 - ground by removing residues, nuclear activity, 284
 - overgrowing with vegetation, 277
 - radiometric parameters, 277, 278
 - radionuclide activity concentration in top (contact) soil, 277–279
 - radionuclide carry-over by plants, 276, 280–282
 - remediated spots overgrowing with vegetation, 282
 - selection of research areas, 274–276
- Soil rehabilitation, 274
- Soil remediation
 - electrokinetic remediation process, 11
 - ISV, 13
 - phytoremediation, 14
 - PNL, 12
 - radioactive soil, 9
 - radioecological models, 20
 - and waste, 9
- Soil un-remediated, 260–262
- Solid radioactive waste, 248–250
 - after deactivation
 - organic RW, 249
 - soil and ground, 248
 - spent sorbents, 249–250
- Sorbents, 226–230, 232–240
- Sorption method
 - aluminosilicates, 54
 - cesium radionuclides, 56, 59–62
 - cesium sorption, 54
 - characteristics, 53
 - clinoptilolite, 52
 - ecological safety, 57–59
 - ferrocyanide sorbents, 58
 - ferrocyanides leaching, 58
 - glauconite, 55
 - materials, 51, 52
 - nickel and ferrocyanide ions, 57
 - NPF-Cl sorbent, 54, 56
 - NPF-GI sorbents, 54
 - radionuclides, 52
 - rehabilitation, 52–53
 - Shivertoyskoye deposit, 55
 - specificity and capacity, 53
 - strontium radionuclides, 56
 - surface-modified sorbents, 60
- Special Decontamination Area (SDA), 259
- Spent sorbents
 - and filters, 253–254
 - solid radioactive waste, 249–250
- ^{88}Sr isotope, 37
- Stabilisation/solidification (S/S), 44
- Stochastic dose, 307
- Stochastic effects, 309
- Straggling of the range, 299
- Strontium (II), *see* Humic acids (*HA*)
- Strontium-90 (^{90}Sr)
 - action mechanism, 151–154
 - agricultural production, 159
 - agricultural techniques, 159
 - agrochemical indicators, 151
 - ameliorants, 150
 - behaviour, 140–143
 - bioavailability parameter, 154
 - biological hazard, 139
 - cereal crops, 150
 - Chernobyl accident, 139
 - distribution coefficients, 147
 - grasslands, 157–158
 - liming, 149, 150
 - mechanical and physicochemical methods, 140
 - mechanical methods, 143–145
 - mineral fertilizers
 - biological mobility, 152–154
 - crops, 146
 - nitrogen, 146–147
 - NPK, 148–149
 - phosphate, 148
 - physicochemical properties, 151–152
 - potassium, 147, 148
 - types, 146
 - minerals and montmorillonite clays, 155

Strontium-90 (^{90}Sr) (*cont.*)
 mobility factors, 142
 nuclear weapon tests, 139
 organic fertilizers, 149
 physicochemical remediation methods,
 145–154
 radiostrontium transfer, dry meadows, 158
 reduction factors, 144
 RSr soil-plant transfer, 158
 sod-podzolic soil, 148, 156
 soil-based remedial techniques, 140
 soil-plant system, 153
 sorbent physicochemical properties, 156
 sorbents, 154, 156
 Styrofoam[™], 210
 Surface-modified sorbents, 226

T

Technical Assessment Group (TAG), 13
 Temporary permissible levels, 230
 Territory STS, 286–288
 Tetrafluoride, 166
 Thermoluminescent dosimeters (TLDs), 310
 Thin-layer inorganic sorbents (TLIS), 226, 227
 Thin-layer modification method, 227
 Threshold energy, 297
 Threshold level, 309
 Tissue weighting factors, 305, 306
 Titanium dioxide, 103
 Top (contact) soil, radionuclide activity
 concentration, 277–279
 Topsoil mixing, 263, 264, 266, 268, 270
 Topsoil stripping, 260, 263, 264, 266, 268,
 270, 271
 Transport packaging containers (TPC), 284
 Treatment of RW, 250–253
 decontamination
 soils and grounds, 250, 251
 solutions after deactivation, 251–253
 radioactive biological waste, 254, 255
 spent sorbent and filters, 253–254
 Tsar Bomba test, 172

U

Underground nuclear explosions (tunnels and
 boreholes), 273

Underground nuclear tests, 273, 287
 United Nations Environmental Program
 (UNEP) reports, 173
 University of Science and Technology Houari
 Boumediene (USTHB), 37

Uranium

concentration, 225
 drainage waters, 202
 mine tailings, 212
 mining and milling, 164–166
 in shoots, 208

V

Vitrification, 45, 46

W

Waste disposal, 93
 Waste management, 93
 Water contamination, 225
 Water decontamination, 223, 229
 contamination of natural water, 225
 drinking water (*see* Drinking water
 decontamination)
 HLW, 223
 natural water bodies, 224, 226–229
 NORMs, 225
 nuclear weapon tests, 224
 radioactive fallouts, 223
 radionuclides (*see* Radionuclides)
 Water remediation
 attenuation technologies, 6
 COCs, 3
 groundwater, 4
 hydraulic performance, 5
 mill tailings, 5
 PTW project, 4
 US Department of Energy's Hanford Site, 3
 Water treatment plants, drinking water, 240
 Waterproof clayey soils, 248
 Weighting factors, 306
 West Valley Demonstration Project treatment, 4
 Wet gravity separation method, 250

Y

Yeast, 96–97