First-Order Decay Rate and Half-lives for Selected Pollutants

(Data taken from: Nuclide and Isotopes, Chart of the Nuclides (Ed) F.W. Walker, J.R. Parrington, F. Feiner, General Electric Company, 1989)

Radioactive Substances	Half-life (time)	Decay Rate ($time^{-1}$)
[4]Actinium-227	21.77 yr	3.18×10^{-2} yr^{-1}
[3]Americium-241	432.7 yr	1.60×10^{-3} yr^{-1}
Arsenic-76	26.3 hr	2.64×10^{-2} hr^{-1}
Beryllium-7	53.28 d	1.30×10^{-2} d^{-1}
[1,3]Bromide-82	1.475 d	4.71×10^{-1} d^{-1}
Cadmium-109	462.0 d	1.50×10^{-3} d^{-1}
Carbon-14	5730 yr	1.21×10^{-4} yr^{-1}
Cerium-141	32.5 d	2.13×10^{-2} d^{-1}
Cerium-143	1.38 d	5.02×10^{-1} d^{-1}
[4]Cerium-144	284.6 d	2.44×10^{-3} d^{-1}
Cesium-134	2.065 yr	3.36×10^{-1} yr^{-1}
Cesium-135	2.3×10^{6} yr	3.01×10^{-7} yr^{-1}
Cesium-136	13.16 d	5.27×10^{-2} d^{-1}
[3,4]Cesium-137	30.17 yr	2.30×10^{-2} yr^{-1}
Chlorine-136	3.01×10^{6} yr	2.30×10^{-6} yr^{-1}
[2]Chromium-51	27.70 d	2.50×10^{-2} d^{-1}
Cobalt-56	77.3 d	8.97×10^{-3} d^{-1}
[2,3]Cobalt-57	271.8 d	2.55×10^{-3} d^{-1}
Cobalt-58	70.88 d	9.78×10^{-3} d^{-1}
[3]Cobalt-60	5.271 yr	1.32×10^{-1} yr^{-1}
Copper-64	12.70 hr	5.46×10^{-2} hr^{-1}
[4]Europium-154	8.59 yr	8.07×10^{-2} yr^{-1}
[2]Fluorine-18	1.83 hr	3.79×10^{-1} hr^{-1}
[1,3]Iodine-125	60.1 d	1.15×10^{-2} d^{-1}
Iodine-126	13.0 d	5.33×10^{-2} d^{-1}
[4]Iodine-129	1.57×10^{7} yr	4.41×10^{-8} yr^{-1}
[1,3,4]Iodine-131	8.040 d	8.62×10^{-2} d^{-1}
[2]Iron-59	44.51 d	1.56×10^{-2} d^{-1}
[4]Krypton-85	10.73 yr	6.46×10^{-2} yr^{-1}
[4]Lead-210	22.3 yr	3.11×10^{-2} yr^{-1}
Molybdenum-99	2.748 d	2.52×10^{-1} d^{-1}
Neodymium-147	10.98 d	3.31×10^{-2} d^{-1}
[4]Neptunium-237	2.14×10^{6} yr	3.24×10^{-7} yr^{-1}
Nickel-63	100. yr	3.96×10^{-3} yr^{-1}
[2]Phosphorus-32	14.28 d	4.85×10^{-2} d^{-1}
Potassium-40	1.28×10^{9} yr	5.42×10^{-10} yr^{-1}
[4]Plutonium-239	2.41×10^{4} yr	2.88×10^{-5} yr^{-1}

[4]Plutonium-240	6.56×10^{3} yr	1.06×10^{-4} yr^{-1}
[4]Radon-226	7.4 m	9.37×10^{-2} m^{-1}
[4]Ruthenium-106	1.02 yr	6.78×10^{-1} yr^{-1}
[1,2]Selenium-75	119.8 d	5.79×10^{-3} d^{-1}
Sodium-22	2.605 yr	2.7×10^{-1} yr^{-1}
[2]Strontium-85	64.84 d	1.07×10^{-2} d^{-1}
Strontium-89	50.52 d	1.37×10^{-2} d^{-1}
[4]Strontium-90	29.1 yr	2.38×10^{-2} yr^{-1}
[2]Technetium-99m	6.01 hr	1.15×10^{-1} hr^{-1}
[4]Thorium-230	7.54×10^{4} yr	9.19×10^{-6} yr^{-1}
[4]Thorium-232	1.40×10^{10} yr	4.95×10^{-11} yr^{-1}
Tin-119	293 d	2.37×10^{-3} d^{-1}
[1,3,4]Tritium (^{3}H)	12.3 yr	5.64×10^{-2} yr^{-1}
[4]Uranium-234	2.46×10^{5} yr	2.82×10^{-6} yr^{-1}
[4]Uranium-238	4.47×10^{9} yr	1.55×10^{-10} yr^{-1}
Xenon-133	5.243 d	1.32×10^{-1} d^{-1}
Zinc-65	243.8 d	2.84×10^{-3} d^{-1}

1 used as hydrologic tracer
2 used in medical applications
3 industrial sources
4 associated with the nuclear power and weapons

Organic Compound[5]	Half-life[6] (time)	Decay Rate ($time^{-1}$)
Acenaphthene	204 d	3.4×10^{-3} d^{-1}
Acenaphthylene	120 d	5.78×10^{-3} d^{-1}
Aldrin	3.2 yr	2.17×10^{-1} yr^{-1}
Anthracene	2.5 yr	2.77×10^{-1} yr^{-1}
Benzene	68 d	1.02×10^{-2} d^{-1}
Benzo-a-anthracene	3.73 yr	1.86×10^{-1} yr^{-1}
Benzo-a-pyrene	2.9 yr	2.39×10^{-1} yr^{-1}
Bromoform	365 d	1.90×10^{-3} d^{-1}
Carbon tetrachloride	360 d	1.93×10^{-3} d^{-1}
Chlordane	7.6 yr	9.12×10^{-2} yr^{-1}
Chlorobenzene	300 d	2.31×10^{-3} d^{-1}
Chloroethane	56 d	1.24×10^{-2} d^{-1}
Chloroform	56 d	1.24×10^{-2} d^{-1}
2-Chlorophenol	2.5 d	2.77×10^{-1} d^{-1}
Chrysene	5.48 yr	1.26×10^{-1} yr^{-1}
4,4-DDD	31.3 yr	2.22×10^{-2} yr^{-1}
4,4-DDE	31.3 yr	2.22×10^{-2} yr^{-1}

4,4-DDT	31.3 yr	2.22×10^{-2} yr^{-1}
Dichlorobenzene	110 d	6.30×10^{-3} d^{-1}
1,1-Dichloroethane (DCA, 1,1)	144 d	4.81×10^{-3} d^{-1}
1,2-Dichloroethane (DCA, 1,2)	365 d	1.90×10^{-3} d^{-1}
1,2-*trans*-Dichloroethylene	266 d	2.61×10^{-3} d^{-1}
1,2-cis-Dichloroethylene	140 d	4.95×10^{-3} d^{-1}
Dieldrin	6 yr	1.15×10^{-1} yr^{-1}
Diethyl phthalate (DEP)	112 d	6.19×10^{-3} d^{-1}
Dimethyl phthalate (DMP)	14 d	4.95×10^{-2} d^{-1}
2,4-Dinitrophenol	17.5 d	3.96×10^{-2} d^{-1}
2,4-Dinitrotoluene	1 yr	6.93×10^{-1} yr^{-1}
A-Endosulfan-alpha	9.1 d	7.62×10^{-2} d^{-1}
B-Endosulfan-beta	9.1 d	7.62×10^{-2} d^{-1}
Ethylbenzene	228 d	3.04×10^{-3} d^{-1}
Fluoranthene	2.4 yr	2.89×10^{-1} yr^{-1}
Fluorene	120 d	5.78×10^{-3} d^{-1}
Heptachlor	5.4 d	1.28×10^{-1} d^{-1}
Heptaclor epoxide	3 yr	2.31×10^{-1} yr^{-1}
Hexachlorobenzene	11.4 yr	6.08×10^{-2} yr^{-1}
gamma-BHC (lindane)	240 d	2.89×10^{-3} d^{-1}
Nitrobenzene	1.08 yr	6.42×10^{-1} yr^{-1}
2-Nitrophenol	28 d	2.48×10^{-2} d^{-1}
4-Nitrophenol	9.8 d	7.07×10^{-2} d^{-1}
Parathion	130 d	5.33×10^{-3} d^{-1}
Pentachlorophenol (PCP)	13.7 d	5.06×10^{-2} d^{-1}
Phenanthrene	1.1 yr	6.30×10^{-1} yr^{-1}
Phenol	7 d	9.90×10^{-2} d^{-1}
Pyrene	10.4 yr	6.67×10^{-2} yr^{-1}
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	3.23 yr	2.15×10^{-1} yr^{-1}
Tetrachloroethylene (PCE)	2 yr	3.47×10^{-1} yr^{-1}
Toluene	8 d	8.66×10^{-2} d^{-1}
1,2,4-Trichlorobenzene	365 d	1.90×10^{-3} d^{-1}
Trichloroethylene (TCE)	4.49 yr	1.54×10^{-1} yr^{-1}
2,4,6-Trichlorophenol	5 yr	1.39×10^{-1} yr^{-1}
Vinyl chloride	7.92 yr	8.75×10^{-2} yr^{-1}
Xylene, ortho and para	30 d	2.31×10^{-2} d^{-1}

5 data taken from a compilation contained in Spitz, K. and J. Moreno. A Practical Guide to Groundwater and Solute Transport Modeling. John Wiley & Sons, New York, 1996.

6 represents most recent data and maximum half-life of compound given in Spitz and Moreno (1996).