

Of the 34 radionuclides indicated in Table 4.4-1, twenty-two of them have half-lives over 100 years, eighteen of them have half-lives over 5 thousand years, fourteen of them half half-lives over 100 thousand years, five of them have half-lives over one million years, and one of them has a half-life over one billion years.

The half-life is the time required for half of the radioactive atoms to disintegrate. If you double that period of time, there will be only ONE QUARTER of the original amount remaining. If you triple that time period, only ONE EIGHTH of the original amount will remain. It will take TEN HALF-LIVES for 99.9 percent of the radioactive atoms to be gone, so that only ONE THOUSANDTH of the original amount remains.

If you multiply all those years listed on the previous page (as half-lives) by a factor of 10, you can see just how long that will take! And you can see just how much radioactivity will still be left after hundreds of thousands of years or even millions of years following abandonment !

<u>Radionuclide</u>	<u>Ten Half-Lives</u>	<u>Remaining Activity</u>
Chlorine-36,	3 million years	40 million becquerels
Calcium-41,	1 million years	7.6 million becquerels
Nickel-59,	760 thousand years	48 million becquerels
Zirconium-93	15 million years	20 million becquerels
Niobium-94,	203 thousand years	70 thousand becquerels
Technetium-99,	1.2 million years	18.9 thousand becquerels
Plutonium-239,	240 thousand years	507 thousand becquerels
Plutonium-242,	3.75 million years	1 thousand becquerels

The longevity of these radioactive materials is measured not just in hundreds of thousands of years, but in millions of years.

And the radiotoxicity of a particular nuclide is not properly indicated by the becquerel count alone. For example, it is well know that, per becquerel, an alpha emitter can be 100 to 200 times more radiotoxic than a beta or gamma emitter. Thus the 507 thousand becquerels of plutonium-239 that will remain after 240 thousand years is equivalent, in radiotoxicity, to 50 million to 100 million becquerels of a typical beta or gamma emitter.