

Murder With Radioactive Polonium Metal

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ABSTRACT: The physical and biological aspects of polonium-210, one of the most hazardous radioisotopes, are summarized. Although this radioisotope is naturally occurring and rare, it received quite a bit of attention after it was used in the 2006 assassination of former Russian Intelligence member Alexander Litvinenko in London. Recent reports on the suspected murder of Yasser Arafat with polonium-210 are also discussed.

KEY WORDS: Ionizing radiation, polonium-210, radiation syndrome.

INTRODUCTION — About Polonium-210

Polonium — A Naturally Occurring Element

Polonium is a very rare naturally occurring element. Polonium is part of the uranium decay chain of the uranium series (**Figure 1**) and is highly associated with radon, which is known to cause lung cancer [52]. The beta-minus decay of bismuth-210, which has a half-life of 5 days, produces polonium-210. The alpha decay of polonium-210, which has a half-life of 138 days, produces the stable lead-206 isotope.

Discovery and Occurrence

Polonium was discovered in 1898 by Marie Curie and Pierre Curie. It was found in uranium ore at approximately 0.1 mg per 1 ton of uranium ore [4,12]. Polonium has also been found in tobacco leaves grown with phosphate fertilizers [31].

Polonium-210 has been found in cigarette smokers' lungs [18]. In smokers consuming two packages of cigarettes a day, their lungs may be exposed to 10 Sv or more in 25 years [37]. Approximately 2% of smoking-related lung cancers are estimated to be associated with internal radiation exposure from polonium-210 [39]. Not only cigarette smoke, but also drinking water in the United States contains small amounts of polonium-210, approximately 7-50 mBq/L [35]. Some areas in Florida and Nevada have higher levels of polonium-210, approximately 1 Bq/L [42]. Annual natural exposure from polonium is estimated to be approximately 10-80 $\mu\text{Bq}/\text{m}^3$ in air [54]. Polonium is also found in the food chain, especially seafood [3]. A typical Westerner's diet includes approximately 37 to 370 mBq/day of polonium-210 [34,46,47].

Polonium-210 can be artificially generated during nuclear reactions (**Figure 2**). Neutron capture of bismuth-209 will create bismuth-210, which becomes

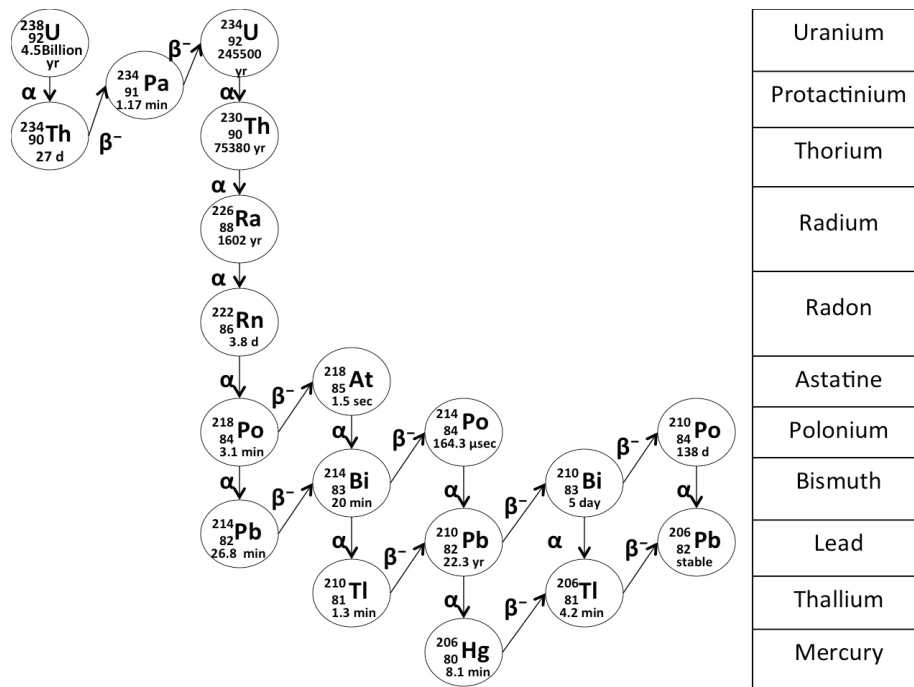


Figure 1. Decay chain of uranium series.



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