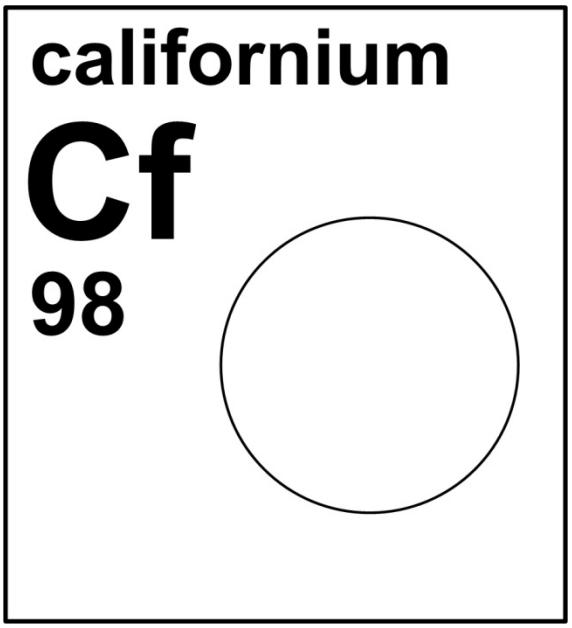
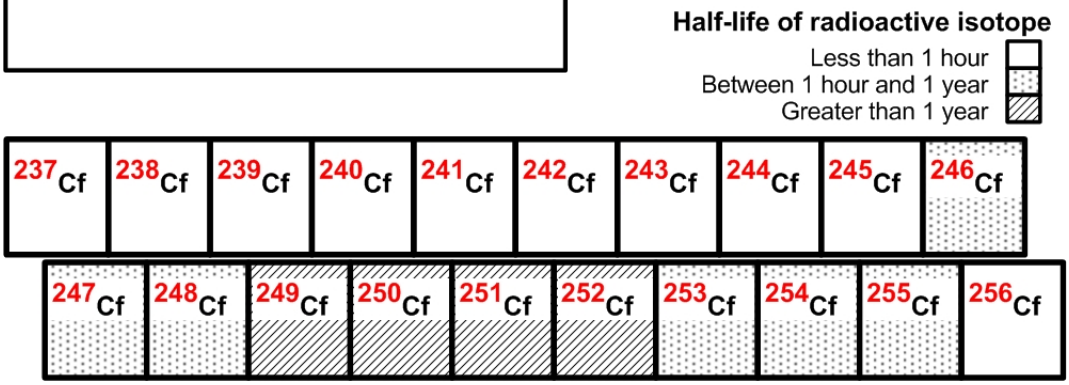
4.98 californium



Stable isotope	Relative atomic mass	Mole fraction
(none)		



Californium does not occur naturally in the Earth's crust. It was first synthesized in 1950 by Glenn T. Seaborg and his team at the University of California using the reaction ^{242}Cm (^{4}He, n) ^{245}Cf. The **element** was named for the state where it was first synthesized.

4.98.1 Californium isotopes in industry

^{252}Cf is a very active source of **neutrons** (2.3×10^{6} neutrons per second per microgram) with a **half-life** of 2.65 years. The energy spectrum of the neutrons is very similar to that of a **fission** reactor, and small amounts of ^{252}Cf provide an ideal portable source for low neutron flux applications [72, 622, 623]. ^{252}Cf is used for PGNAA (prompt gamma neutron activation analysis method for detecting many chemical elements in samples simultaneously) analysis of coal, cement, and minerals, weapon components, and chemical munitions [624]. This method provides quick and non-destructive elemental analysis of a sample. For example, ^{252}Cf, as the neutron source for PGNAA, is used to detect the presence of antitank mines [622].

Neutron activation analysis (NAA) uses ^{252}Cf as a portable neutron source to bombard a small sample from the area of interest with neutrons and analyze the radioactive emissions from

that bombardment to help identify silver or gold ore [72]. ^{252}Cf has been used in neutron moisture gauges to locate water [625]. ^{252}Cf is used in borehole geophysical logging for subsurface PGNAA investigation of waste (Figure 4.98.1) [626].
Formation fluid identification uses ^{252}Cf as a chemical neutron source for elastic/inelastic neutron backscattering and/or neutron activation methods in well-logging to determine water and oil-bearing layers and other downhole properties of the well bore [626].

Fig. 4.98.1: ^{252}Cf is a logging tool used in well logging to identify downhole properties of a well bore. (Photo Source: U.S. Department of Labor- Occupational Safety & Health Administration)

4.98.2 Californium isotopes in medicine

^{252}Cf is sometimes used as a source of neutrons in boron neutron capture therapy (BNCT) that can be delivered close to the region of a tumor [72, 622, 623]. **Brachytherapy** can use ^{252}Cf to treat many types of cancer [72, 622, 623].