

Radiological Air Sample Quarterly Composites

The California Health and Safety Code (HSC) §114755 mandates that the California Department of Public Health (CDPH) “shall monitor radioactive materials in the environment.” To monitor the air, CDPH has placed sampling stations across the state consisting of a totalizing vapor meter and an electric pump that pulls air through a borosilicate glass microfiber filter and a TEDA-impregnated 20x40 mesh carbon cartridge. The sample media are exchanged weekly and delivered to the CDPH Drinking Water and Radiation Laboratory (DWRL) for analysis. Each quarter, all fiber media collected for the period per site are combined and quantified by gamma spectroscopy in a high-purity germanium photo-detector. This process is specifically sensitive to long-lived radionuclides.

To convert from “concentration of a radionuclide in air” to “health consequence due to inhalation of radionuclides”, one method is to use the conversion factors found in Title 10 of the Code of Federal Regulations, Part 20, Appendix B, Table 2, Column 1. The concentrations listed correspond to a Total Effective Dose Equivalent (TEDE) of 50 millirem for a person exposed continuously for one year. The table presented here contains an additional column of factors that have been converted into the units reported by DWRL.

Two reported nuclides are part of the natural background. Beryllium-7 is generated continuously on Earth by cosmic ray interactions with matter, so it will always be measured in air. Potassium-40 comprises a small proportion of all natural potassium found throughout the Earth’s crust and waters. The remainder of the nuclides found on the reports are products of fission processes. Cesium-137 can be found across the globe due to atmospheric nuclear weapons tests, the last of which occurred on October 16, 1980. When soil containing fallout is disturbed either by weather or by human activity, the material can become airborne along with the dust. Due to this resuspension, small concentrations of Cesium-137 may be detected but, without detection of additional fission products, is not indicative of new radiological contamination.

According to the National Council on Radiation Protection and Measurements (NCRP) Report No. 160, the average annual radiation dose per person in the U.S. is 620 millirem, which includes exposure from natural background sources and from medical diagnostic and therapeutic procedures. The largest dose (TEDE) during any quarter from 2012 through 2014 was 0.000104 millirem (from Be-7 and K-40).

10 CFR 20, Appendix B, Table 2		
Nuclide	μCi/mL per 50 mrem*	pCi/m³ per mrem
Beryllium-7	3E-08	600
Cerium-141	8E-10	16
Cerium-144	2E-11	0.4
Cesium-134	2E-10	4
Cesium-137	2E-10	4
Niobium-95	2E-09	40
Potassium-40	6E-10	12
Ruthenium-103	9E-10	18
Ruthenium-106	2E-11	0.4
Zirconium-95	4E-10	8

*Note on scientific notation: 3E-08 = 3×10^{-8} = 0.00000003