

From: Philippe Duport <[pduport@uottawa.ca](mailto:pduport@uottawa.ca)>  
Low Dose Radiation Research Center (LDRRC) - University of Ottawa  
Date: Thursday, December 21, 2000

**Question: Doses from radon**

**Answer:** Radon dosimetry is not an exact science! There is no direct relation between radon concentration in air and dose because the radiation that counts comes from the first 4 short-lived decay products of radon. The decay products that follow have long half lives and do not contribute significantly to the dose.... According to the ICRP, an exposure of 1 Working Level Month (WLM) is equivalent, in terms of risk, to 5 mSv. This is based on epidemiology, with extrapolation of the risk outside of the range of observed values. A Working Level (WL) is a unit concentration per liter of air of potential alpha energy that will be released ultimately by 100 pCi (picocuries) of all short lived radon decay products contained in 1 liter of air. When there is 100 pCi/l of radon and 0.5 WL, the “energy equilibrium” is 0.5. At the Free Enterprise Radon Health Mine, we can guess an equilibrium of about 0.4 - that is, for every 100 pCi/l of radon there is an energy concentration of 0.4 WL. With an equilibrium factor of 0.4, 1200 pCi/l (average radon concentration in the Mine) is about equivalent of  $12 \times 0.4 = \text{about } 5 \text{ WL}$ , therefore Dose = 40 h (approx. radon exposure over about 10 days)  $\times 5 \text{ WL} = 200 \text{ WL h/WLM} = \text{about } 1.2 \text{ WLM} = 6 \text{ mSv}$ .

---

From: Bruce Busby, RSO  
Health Physics Society  
<http://www.hps.org>

**Question: What is the relationship between rem, rad, Roentgen (R), and Sievert (Sv)?  
How does one compare the doses?**

**Answer:** This is not as easy as you might think since it depends on what source of information you use. Dose equivalent and effective dose equivalent are both expressed in rem or Sv. Rem and rad are “english” units, while Gray (Gy) and Sieverts (Sv) are SI units....  $1 \text{ rem} = 1 \text{ rad} \times Q$  (Quality factor)... For most gamma and beta sources, Q is equal to 1. It also works out that for a “rough” estimate for beta, x-ray, and gamma sources  $1 \text{ R} = 1 \text{ rad} = 1 \text{ rem} = 10 \text{ mSv}$ .

---

***Therefore, based upon the above statements, a rough estimate of a standard Mine therapy stay of about 40 hours over approximately 10 days calculates to about:***  
***6 mSv = 0.6 rads = 0.6 R = 0.6 rem***

Patricia Lewis  
(Free Enterprise Radon Health Mine, Boulder MT)

---

**Note:** *“Unfortunately, simple correlations between activity (curie) and exposure rate (mR/hr) or dose equivalent rate (mSv/hr) cannot be given. Accurate calculations require consideration of other parameters including composition and radionuclide(s), geometry, shielding, and scatter....”* Robert L. Coleman (Oak Ridge National Lab)