

This is an email sent by:  
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The way I evaluated the dose rate of Boron beta decay is as follows:  
 First, 1 joule is equal to  $6.24 \times 10^{12}$  MeV, and the decay energies of both Boron 12 & 13 round off to 13.4 MeV.

And since the natural abundance of Carbon 12 is ~99% and Carbon 13 is ~1% I divided the  $6.24 \times 10^{12}$  MeV of total decay energy for 1 joule into  $6.18 \times 10^{12}$  MeV for Boron 12 decay and  $6.24 \times 10^{10}$  MeV for Boron 13 decay.

As per the usual convention I omitted decay modes that comprise less than 1% of the total energy release.

Percent & amount of energy	Betas	Gammas	Count each Particle
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[ Boron 12 -- Total energy  $6.18 \times 10^{12}$  MeV ]

92.2%	$6.01 \times 10^{12}$ MeV	13.4 MeV		$4.48 \times 10^{11}$
1.50%	$9.27 \times 10^{10}$ MeV	5.71 MeV	3.21 MeV & 4.43 MeV	$6.92 \times 10^9$
1.23%	$7.60 \times 10^{10}$ MeV	8.93 MeV	4.43 MeV	$5.67 \times 10^9$

[ Boron 13 -- Total energy  $6.24 \times 10^{10}$  MeV ]

91.2%	$5.75 \times 10^{10}$ MeV	13.4 MeV		$4.29 \times 10^9$
7.60%	$4.74 \times 10^9$ MeV	9.75 MeV	3.68 MeV	$3.54 \times 10^8$

Derived Gamma Averages:

Gamma	Total Count	Total Energy
4.43 MeV	$1.26 \times 10^{10}$	$5.58 \times 10^{10}$ MeV
3.21 MeV	$6.92 \times 10^9$	$2.22 \times 10^{10}$ MeV
3.68 MeV	$3.54 \times 10^8$	$1.30 \times 10^9$ MeV
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3.99(Avg) MeV	$1.99 \times 10^{10}$	$7.93 \times 10^{10}$

From this I derived the dose rate using the unshielded dose rate equation number two in the "Shielding for Gamma Radation.pdf".

kSEUen/P

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$4 \pi r^2$

I used:

$k = 1.60 \times 10^{(-10)}$  Value for grays per second

$S = 1.99 \times 10^{10}$  Gammas per second

$E = 3.99$  MeV

$Uen/P = 2.045 \times 10^{(-2)}$  Soft tissue & 4 MeV

$r = 100$ cm

$$\frac{1.60 \cdot 10^{-10} * 1.99 \cdot 10^{10} * 3.99 * 2.045 \cdot 10^{-2}}{4 \cdot \pi \cdot 100^2} = 2.07 \cdot 10^{-6} \text{ grays per joule}$$

The result actually gives the dose rate per joule of raw emitted decay energy. Multiply this figure by the watts output by the Boron to get grays per second.

Best regards,

Fred  
25.09.2007