Comparison between calculated and measured equivalent doses caused by heavy ions

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Ambient equivalent doses behind thick shields are calculated using the data derived by Weise (1). These data include neutron yields, estimated by using measured differential neutron and proton production cross sections of heavy ion reactions, and effective neutron dose transmission factors for ordinary concrete.

The ambient neutron doses are measured by normal REM-counters during the course of high energy physics experiments. Accelerated ions of carbon, nickel and gold are stopped in an iron beam dump. The specific energies (energy per nucleon) are between 1 and 2 GeV/n. The ambient doses at the location of the REM-counter are calculated using data for the reaction Ne $\rightarrow$ Fe at 2 GeV/n. The results are

accelerated ion	specific energy (Gev/n)	accelerated ions per second	calculated dose (µSv/h)	measured dose (µSv/h)
C	2.0	2.7 E+07	4.7 E-01	3.7 E-01
Ni	1.9	9.2 E+05	1.6 E-02	8.5 E-02
Au	1.0	1.8 E+06	1.9 E-01	3.5 E-01

For the carbon and gold ions the measured doses match well to the calculated doses. In the case of the nickel ions there is a discrepancy, the measured results are a factor of about 5 higher than the calculated results. These differences may be caused by beam losses outside the beam stop.

References:

(1) Weise, H.-P.; Shielding of high enery accelerators; Proceedings of the 7th International Conference on Radiation Shieldings, Bournemouth, p. 903 - 911 (1988)