HEALTH PHYSICS FINAL EXAM JUNE 16, 1997 15:00 - 17:00

PROBLEM 1 Explain the following dose terms and their differences: (18 points)

a. exposure b. absorbed dose c. dose equivalent

d. total effective dose equivalent f. collective dose equivalent g. dose commitment

PROBLEM 2 Discuss the following abbreviations: (15 points)

a. SEE (T←S) b. ALI c. DAC d. MPC e. ALARA

PROBLEM 3 Explain the stochastic effects of radiation and its implications in setting the dose limits recommended by ICRP-60(1990). (12 points)

PROBLEM 4 A thermal neutron flux field exits in a certain area. A BF_3 counter is used to measure the neutron flux. 10 gross-count measurements for a 1-second interval and 10 background measurements for a 10-minute interval are made as shown in the following table, respectively. (45 points)

ni	gross	background	ni	gross	background
1	2300	22	6	2425	24
2	2325	20	7	2390	23
3	2345	21	8	2400	20
4	2400	19	9	2320	22
5	2360	23	10	2315	21

a. Find the net count rate (cpm) with 1-σ error.

b. Find the thermal neutron flux level (n/sec.cm^2). The BF_3 counter has a sensitive volume of 60 cm^3 with the filling gas of 98% enriched B^{10} at 15 cm Hg and 20°C.

Data: σ_a of B^{10} at 2200 m/sec = 3,840 b.

c. Calculate the dose equivalent to a 70-kg man due to exposure form this thermal neutron flux. The dose is composed of the doses from 0.63 MeV protons and 2.23 MeV photons which are produced by the reactions: $N^{14}(n,p)C^{14}$ and $H^1(n,\gamma)H^2$.

Data: # of nitrogen atoms per kg of tissue = 1.49×10^{24}/kg

# of hydrogen atoms per kg of tissue = 5.98×10^{25}/kg

σ_a of nitrogen = 1.75 b. σ_a of hydrogen = 0.33 b

AF(total body←total body) = 0.278 for 2.23 MeV photons.

PROBLEM 5 A room is contaminated by tritium gas. When a person is exposed in the air, what are the dose contributions to the exposed person from tritium gas? (10 points)