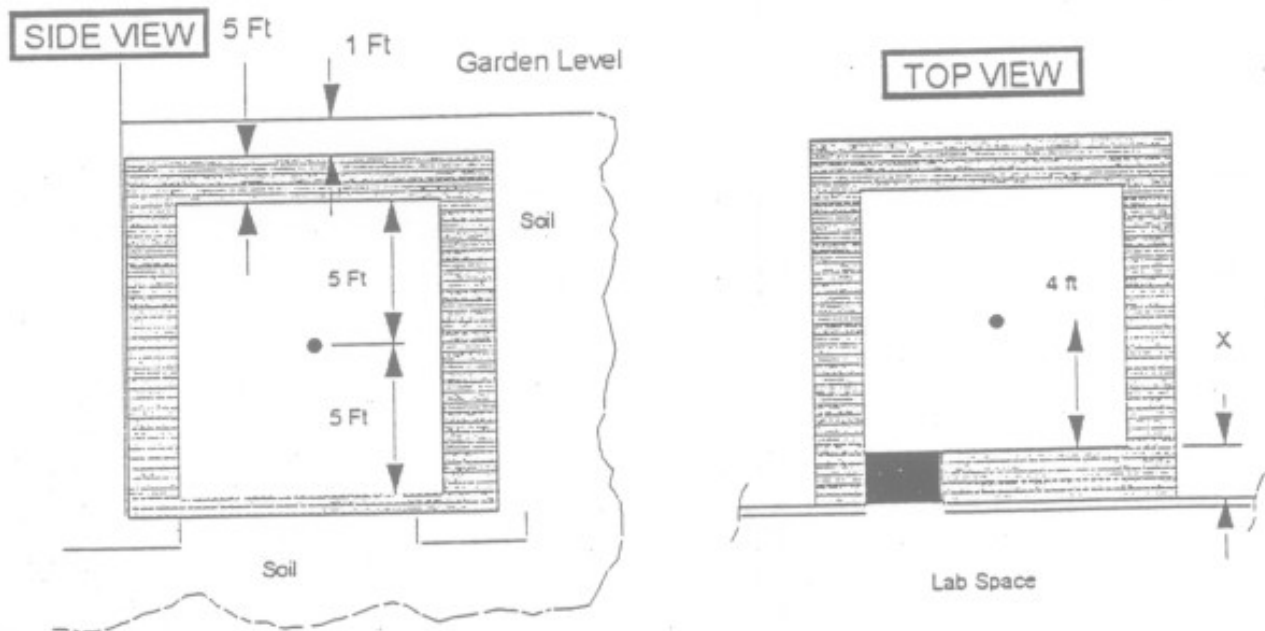


QUESTION 10

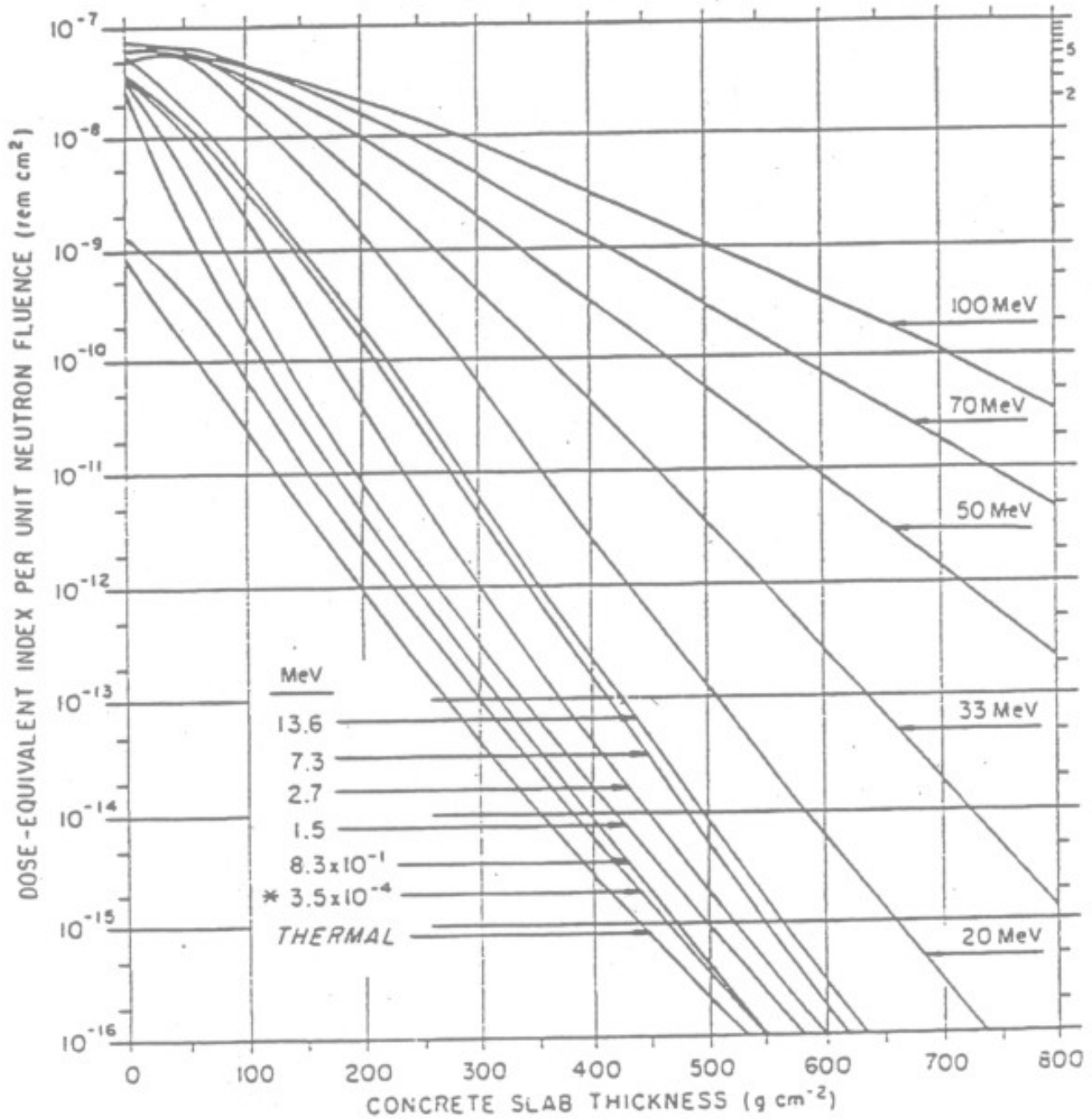
The radiation physics group at your research facility wants to use their accelerator to produce 14-MeV neutrons using the ${}^3\text{H}(d,n){}^4\text{He}$ reaction. The group asks you to design shielding for the walls and ceiling.

GIVEN:

Q	+ 17.586 MeV
Deuteron energy on target	0.150 MeV
Deuteron fluence rate on target	$6.25 \times 10^{13} \text{ d cm}^{-2} \text{ s}^{-1}$
Total reaction cross section	5 b
Maximum deuteron current on target	10 μA
Concrete density	2.31 g cm^{-3}
Beam diameter	1 cm^2
Tritium target activity	10 Ci in 1 cm^2 active area
Fluence to dose conversion at 14 MeV	$1.7 \times 10^7 \text{ n cm}^{-2} \text{ rem}^{-1}$



Dose-Equivalent Index Transmission Through Concrete of Monoenergetic Neutrons



Dose-equivalent index transmission per unit fluence (rem cm²) of monoenergetic neutrons incident normally on slabs of ordinary concrete (TSF-5.5, see Appendix H-2). Multi-collision dose-equivalent index per unit fluence is calculated to include the dose-equivalent index contribution by capture gamma rays produced within the slab.

POINTS

- 50 A. What is the minimum wall thickness needed so that the dose rate in the lab space will not exceed 0.25 mrem h^{-1} . **Show all work.**
- 40 B. List and justify **four** major elements of an accelerator radiation protection program for this facility. **Number your responses. Only the first four will be graded.**
- 10 C. You propose to use lead and normal polyethylene to construct a temporary shield around the source. In what order should you place these materials and why?