

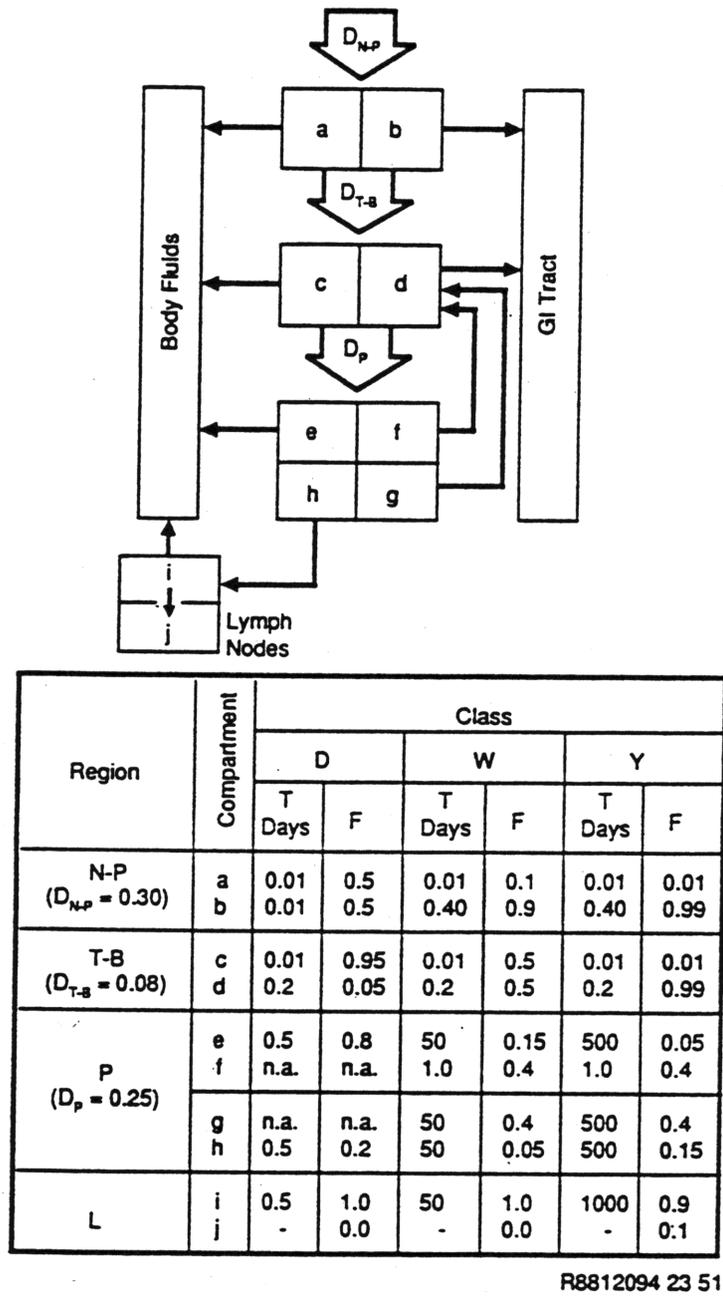
APPENDIX D

ICRP LUNG MODEL

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Figure D.1 presents the International Commission on Radiological Protection (ICRP) lung model as published in ICRP 30 (1979). The deposition fractions, D_{N-p} , D_{T-B} , and D_p , as given in Figure D.1 apply to an aerosol with an activity median aerodynamic diameter (AMAD) of $1 \mu\text{m}$. Figure D.2, also from ICRP 30, shows how the deposition fractions vary as a function of AMAD. Deposition fractions for particle sizes other than $1 \mu\text{m}$ may be estimated from Figure D.2 or may be obtained from Table D.1.



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FIGURE D.1. Mathematical Model Used to Describe Clearance from the Respiratory System. (The values for the removal half-times, T_{a-j} and compartmental fractions, F_{a-j} , are given in the tabular portion of the figure for each of the three classes of retained materials. The values given for D_{N-P} , D_{T-B} , and D_P [left column] are the regional depositions for an aerosol with an AMAD of $1 \mu\text{m}$. The schematic drawing identifies the various clearance pathways from compartments a-j in the four respiratory regions, nasal passages [N-P], tracheal-bronchial tree [T-B], pulmonary [P], and lymph nodes [L].)

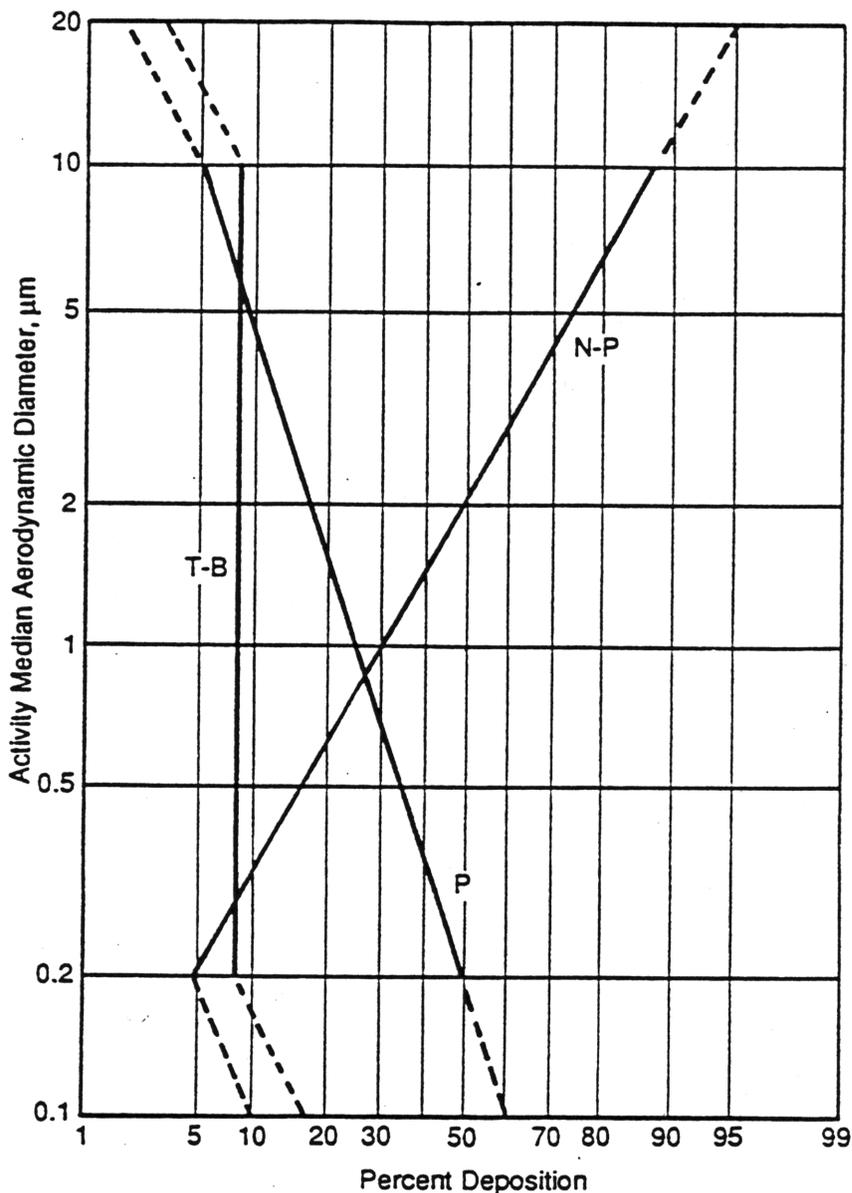


FIGURE D.2. Deposition of Dust in the Respiratory System. (The percentage of activity or mass of an aerosol that is deposited in the N-P, T-B, and P regions is given in relation to the AMAD. The model is intended for use with aerosol distributions with AMADs between 0.2 and 10 μm and with geometric standard deviations of less than 4.5. Provisional estimates of deposition further extending the size range are given by the dashed lines. For an unusual distribution with an AMAD of greater than 20 μm, complete deposition in the N-P region can be assumed. The model does not apply to aerosols with AMADs of less than 0.1 μm.)

TABLE D.1 Deposition Fractions as a Function of Aerosol AMAD^(a)

<u>AMAD, μm</u>	<u>Deposition Fractions</u>	
	<u>N-P^(b)</u>	<u>P^(c)</u>
0.2	0.050	0.50
0.3	0.088	0.43
0.4	0.13	0.38
0.5	0.16	0.34
0.6	0.19	0.32
0.7	0.23	0.30
0.9	0.26	0.28
1.0	0.30	0.25
2.0	0.50	0.17
3.0	0.61	0.13
4.0	0.69	0.10
5.0	0.74	0.088
6.0	0.78	0.076
7.0	0.81	0.067
8.0	0.84	0.060
9.0	0.86	0.055
10.0	0.87	0.050

(a) From NUREG/CR-1962, p. 25 (Eckerman, Watson, and Ford 1981). The deposition fraction for the T-B region is 0.08, independent of AMAD.

(b) N-P = nasal-passage region.

(c) P = pulmonary region.

REFERENCES

Eckerman, K. F., S. B. Watson, and M. R. Ford. 1981. Internal Dosimetry Data and Methods of the ICRP Part 2, Volume 1: Committed Dose Equivalent and Secondary Limits. NUREG/CR-1962, U.S. Nuclear Regulatory Commission, Washington, D.C.

International Commission on Radiological Protection (ICRP). 1979. Limits for Intakes of Radionuclides by Workers. ICRP Publication 30, Part 1 and Supplements, Pergamon Press, New York.