Application of the ICRP Respiratory Tract Model to Estimate Pulmonary Retention of Industrially-Sampled Indium-Containing Dusts

Aleksandr B. Stefaniak*, M. Abbas Virji, Melissa A. Badding, Kristin J. Cummings

National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Morgantown, WV, 26505, USA (AStefaniak@cdc.gov, MVirji@cdc.gov, Mbadding@cdc.gov, KCummings@cdc.gov)

*Correspondence to:
Aleksandr B. Stefaniak
National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention
Mailstop H-2800
Morgantown, WV 26505, USA
Phone: +1.304.285.6302
Fax: +1.304.285.6321
E-mail: AStefaniak@cdc.gov

Supplemental File 1

Figure S1 summarizes the International Commission on Radiological Protection (ICRP) model for particle lung deposition and clearance. The deposition model (Figure S1a) assumes that the lung acts as a series of filters that dictate regional lung deposition for particles across a range of sizes. For mechanical clearance (Figure S1b), the default rate constants from the ICRP human respiratory tract model (HRTM) were used in calculations. For chemical clearance (Figure S1c), the measured indium dissolution rates in phagolysosomal simulant fluid were used in calculations.

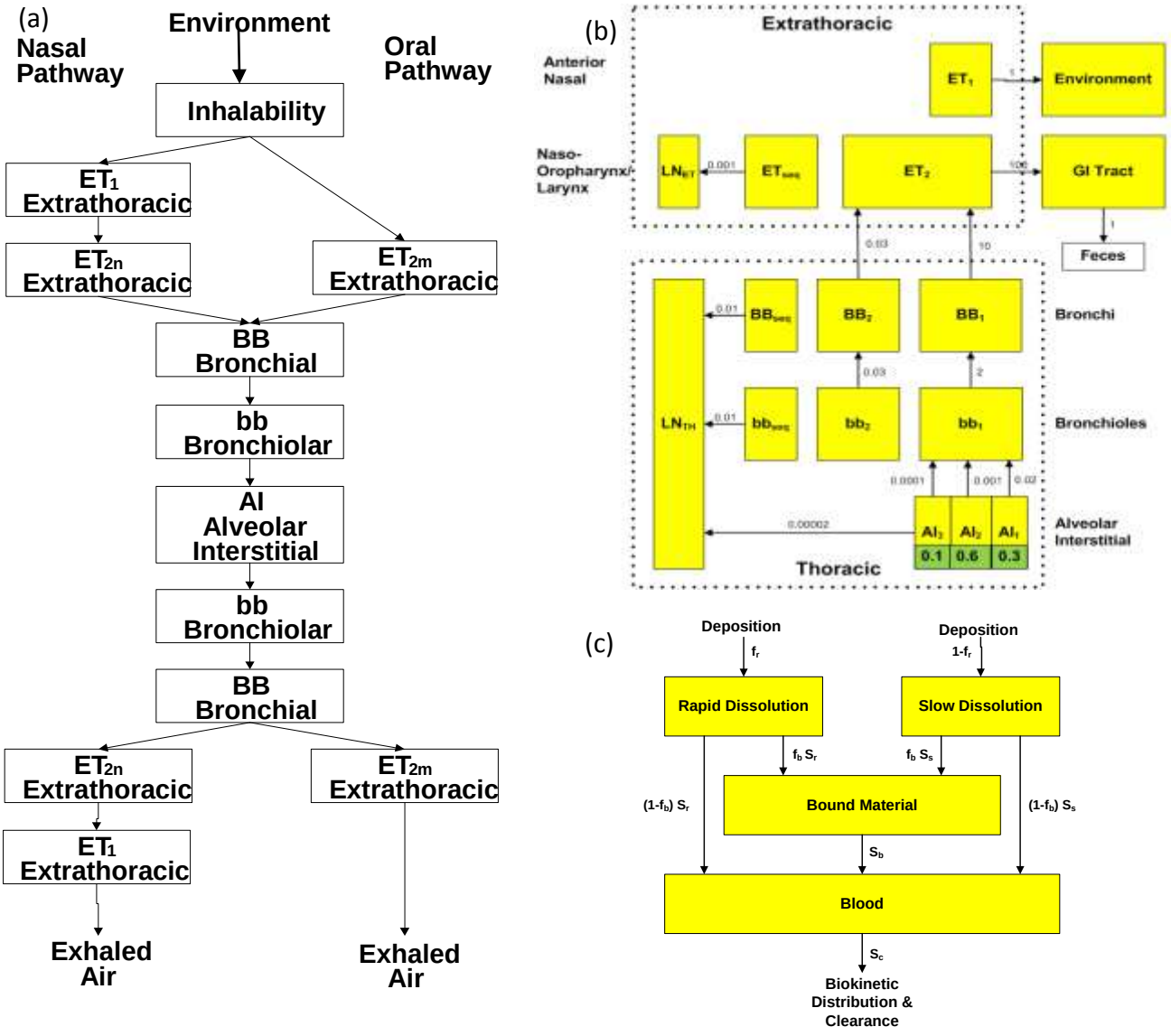

Figure S1. International Commission on Radiological Protection (ICRP) human respiratory tract model (HRTM) for particle (a) lung deposition, (b) mechanical clearance, and (c) chemical clearance.

Figure S2 summarizes clearance predicted by the ICRP HRTM for respirable size indium oxide (In_2O_3), sintered indium tin oxide (SITO), and ventilation dust (VD) particles for a reference human with heavy breathing and 100% nose breather. For indium oxide (In_2O_3), the percent difference between light work (Figure 2 in main text) and heavy exercise (Figure S1 in the Supplemental File) ranged from 22 to 31% for alveolar (AI) retention and 24-34% for plasma (PL) retention for the 2 and 40 year

models, respectively. For SITO particles, the percent difference between models was similar to indium oxide for light work and heavy exercise but for VD particles they were larger (35-37%).

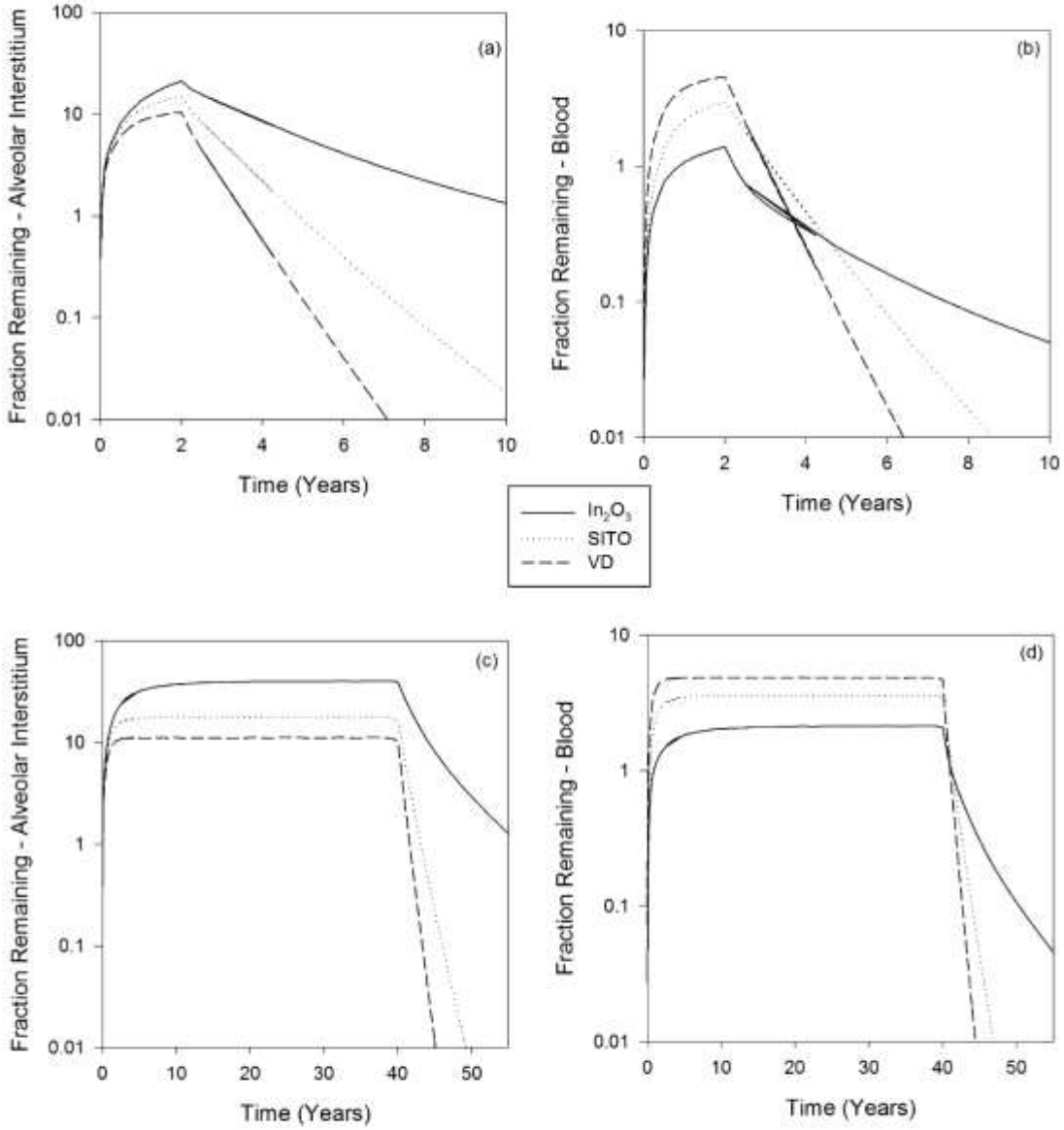

Figure S2. Two year exposure: (a) lung alveoli, (b) blood. Forty year exposure: (c) lung alveoli, (d) blood for an adult reference worker at heavy exercise and 100% nose breather.