Abstract title: Oncogenic Potency and Risk to Workers and the General Public from Inhaled 1,3-Dichloropropene

Authors: Andrew Rubin, Charles Aldous, Ian Reeve, Peter Lohstroh, Stephen Rinkus, Carolyn Lewis, Miglena Wilbur, Terrell Barry, Eric Kwok, Svetlana Koshlukova, Sheryl Beauvais and Marylou Verder-Carlos

Affiliation: Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, CA

cis (*Z*) isomer *trans* (*E*) isomer

1,3-dichloropropene (1,3-D; MW, 110.98) is a fumigant used to control nematodes, insects and disease organisms in soil. It promotes crop growth by minimizing competition with soil pests. 1,3-D is applied by pre-plant soil injection or drip irrigation. Volatilization creates opportunities for off-site movement and human respiratory exposure. 1,3-D is oncogenic in laboratory animal studies by the oral, dermal and inhalation routes. Male mice exposed to 1,3-D by the inhalation route for 2 years exhibited a concentration-dependent increased incidence of bronchioloalveolar adenomas, becoming statistically significant at 60 ppm. Evidence for genotoxicity in several *in vitro* and *in vivo* tests, combined with the absence of evidence for a threshold concentration, supported use of linearized multistage modeling to calculate oncogenic potencies. The latter values, expressed as air unit risk levels (AURs), were calculated after converting the air concentrations used in the mouse study to human equivalent concentrations (HECs) using the regional gas dose ratio (RGDR) approach. Calculations were carried out assuming both portal of entry (PE) and systemic (SM) modes of oncogenic action, each of which had strong implications for the size of the RGDR scalar. Resultant AURs using the PE assumption were 0.0059 ppm^{-1} and 0.018 ppm^{-1} (occupational and non-occupational exposure scenarios, respectively); using the SM assumption, AURs were 0.02 ppm^{-1} and 0.062 ppm^{-1}. Lifetime breathing zone air concentrations---defined as the daily air concentrations to which an individual is exposed over a lifetime---for occupational scenarios were estimated from direct 1,3-D monitoring studies conducted in Washington, Arizona and North Carolina or from model simulations. These ranged from 8-hr time-weighted averages of 0.0003 ppm (occupational bystander) to 2.8 ppm (tarp remover). Occupational cancer risk---the product of the AUR and the exposure estimate---ranged from $1.9x10^{-6}$ to $1.7x10^{-2}$ assuming a PE mode, and from $6.6x10^{-6}$ to $5.6x10^{-2}$ assuming a systemic mode. Lifetime estimates for ambient scenarios were estimated using simulated air concentrations and two population-based exposure assessment computer models, MCABLE and HEE5CB. The resultant 95^{th}-percentile estimates varied depending on model, gender and residence time assumptions, and ranged from 0.1644 µg/kg/day to 0.8396 µg/kg/day. Ambient cancer risk values ranged from $2.30x10^{-6}$ (MCABLE, female, 30-year fixed exposure, PE mode) to $4.04x10^{-5}$ (HEE5CB, male, low mobility, birth to age 70, SM mode). In conclusion, calculated oncogenic risk values were higher than the negligible oncogenic risk standard of $1x10^{-6}$ for every occupational and non-occupational scenario analyzed including all ambient scenarios. This was the case regardless of the assumed oncogenic mode of action of 1,3-D.