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Logistic Regression of Inhalation Toxicities of Perchloroethylene—Application in Noncancer Risk Assessment[1]

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Unlike the impressive advancement of cancer risk assessment, the "cutoff approach" based on hazard quotient in noncancer risk assessments recommended by the EPA has crucial deficiencies. Several alternative approaches have been suggested in the literature to modify the noncancer risk characterization based on reference doses. Recent studies have indicated that the effects of perchloroethylene (PERC) on the central nervous system (CNS) is a much more sensitive noncancer endpoint than cancer which is currently the basis for deriving its public health criteria and standards. Studies indicate that 20 ppm of inhaled PERC concentration elicited adverse effects on the CNS in experimental animals and humans. However, the existing EPA oral reference dose (RfD), a noncancer toxicity parameter for PERC (0.01 mg/kg/day), is based on the induction of hepatotoxicity and increased body weight gain induced by PERC in rats. An attempt was made in this paper to examine whether logistic regression of dose–response data could be applied to assess the noncancer risks. In order to perform logistic regression the inhalation toxicity data of PERC were classified according to the severity of toxicity paradigm used in toxicity analysis. Based on the sensitive noncancer endpoints identified from severity classification, a logistic regression analysis of the data was performed and its potential applicability in noncancer risk characterization was described for workers exposure to PERC in dry-cleaning operations.

INTRODUCTION

The existing methodology for noncancer risk assessment is based on a toxicity benchmark dose known as reference dose (RfD). RfD is defined as an estimate (with uncertainty spanning perhaps an order of magnitude) of daily exposure to the human population (including sensitive subgroup) that is likely to be without appreciable risk of deleterious effects during a life time (EPA, 1988).

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