

Health-Based and Vegetative Based Effect Screening Values for Ethylene

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ABSTRACT

Ethylene (ET) is ubiquitous in the environment because it is produced in high volumes by the petrochemical industry and because it is often used for controlled ripening of fruits and vegetables. Although a review of human and laboratory animal studies indicate ET to be relatively non-toxic, there is concern about the potential toxicity of ET because ET is metabolically converted to ethylene oxide (EtO). EtO is a suspected human carcinogen, a genotoxicant, and a potent alkylating agent that can form adducts by interacting with cellular macromolecules such as DNA, RNA, and protein (e.g., hemoglobin). Additionally, several studies have reported ET to cause adverse effects to plant species (vegetative effects) at concentrations that are not adverse to humans. Therefore, the Texas Commission of Environmental Quality (TCEQ) conducted detailed health and welfare (odor and vegetative) based assessments of ET to develop both health and vegetative based toxicity factors in accordance with TCEQ Guidelines (TCEQ 2006). The health assessment based on well-conducted animal toxicity studies resulted in identification of higher point of departures and subsequently higher effect screening levels (ESLs) that were more than a magnitude higher than the threshold effect level for vegetative effects for ET. Further, based on a weight-of-evidence evaluation of the mode-of-action it appears that the metabolic conversion of ET to EtO does not pose a cancer risk based on the current knowledge of the significance of adducts (ACGIH, 2005 and IARC 1994). Therefore, the short-term ESL for air permit reviews and air monitoring evaluations is the vegetation-based ESL of 1,200 ppb as it is more than a magnitude lower than the health-based acute ESL of 150,000 ppb. Similar to the acute derivation, the chronic evaluation resulted in the derivation of a chronic vegetation based ESL of 30 ppb that was much lower than the chronic ESL of 1,600 ppb. In summary, the TCEQ's acute and chronic ESLs for vegetation will protect the general public from short-term and long-term adverse health and welfare effects. The general public includes children, the elderly, pregnant women, and people with pre-existing health conditions.