

Biological And Health Effects Of Exposure To Kerosene-Based Jet Fuels And Performance Additives



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Abstract:

Over 2 million military and civilian personnel per year (over 1 million in the United States) are occupationally exposed, respectively, to jet propulsion fuel-8 (JP-8), JP-8 +100 or JP-5, or to the civil aviation equivalents Jet A or Jet A-1. Approximately 60 billion gallons of these kerosene-based jet fuels are annually consumed worldwide (26 billion gallons in the United States), including over 5 billion gallons of JP-8 by the militaries of the United States and other NATO countries. JP-8, for example, represents the largest single chemical exposure in the U.S. military (2.53 billion gallons in 2000), while Jet A and A-1 are among the most common sources of nonmilitary occupational chemical exposure. Although more recent figures were not available, approximately 4.06 billion gallons of kerosene per se were consumed in the United States in 1990 (IARC, 1992). These exposures may occur repeatedly to raw fuel, vapor phase, aerosol phase, or fuel combustion exhaust by dermal absorption, pulmonary inhalation, or oral ingestion routes. Additionally, the public may be repeatedly exposed to lower levels of jet fuel vapor/aerosol or to fuel combustion products through atmospheric contamination, or to raw fuel constituents by contact with contaminated groundwater or soil. Kerosene-based hydrocarbon fuels are complex mixtures of up to 260+ aliphatic and aromatic hydrocarbon compounds (C₆-C₁₇+; possibly 2000+ isomeric forms), including varying concentrations of potential toxicants such as benzene, n-hexane, toluene, xylenes, trimethylpentane, methoxyethanol, naphthalenes (including polycyclic aromatic hydrocarbons [PAHs]), and certain other C₉-C₁₂ fractions (i.e., n-propylbenzene, trimethylbenzene isomers). While hydrocarbon fuel exposures occur typically at concentrations below current permissible exposure limits (PELs) for the parent fuel or its constituent chemicals, it is unknown whether additive or synergistic interactions among hydrocarbon constituents, up to six performance additives, and other environmental exposure factors may result in unpredicted toxicity. While there is little epidemiological evidence for fuel-induced death, cancer, or other serious organic disease in fuel-exposed workers, large numbers of self-reported health complaints in this cohort appear to justify study of more subtle health consequences. A number of recently published studies reported acute or persisting biological or health effects from acute, subchronic, or chronic exposure of humans or animals to kerosene-based hydrocarbon fuels, to constituent chemicals of these fuels, or to fuel combustion products. This review provides an in-depth summary of human, animal, and in vitro studies of biological or health effects from exposure to JP-8, JP-8 +100, JP-5, Jet A, Jet A-1, or kerosene.

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