**Uses:** dithiocarbamate fungicide; contains manganese (essential element but neurotoxic in excess); metabolites include ETU.

**Residues:** drinking water, food.

**Acute toxicity:** nausea, vomiting, diarrhoea, headache, skin rashes, contact dermatitis, conjunctivitis, breathing problems, renal failure, convulsions, fatigue, nervousness, memory lack, behavioural changes, hypothermia.\(^1\)\(^-\)\(^3\) Children are more sensitive than adults;\(^2\) can be life-threatening for children.\(^1\)

**Chronic toxicity:** liver, kidney.\(^2\)\(^4\)

**Neurological:** concern for developmental toxicity, based on neurologic effects on rats;\(^2\) behavioural changes in mice.\(^5\) Associated with Parkinson’s disease,\(^6\)\(^-\)\(^8\) especially early developmental exposures.\(^9\)\(^10\) Maneb interacts with paraquat to increase the risk of Parkinson’s.\(^9\)

**Cancer:** US EPA probable human carcinogen; liver, pituitary, thyroid and lung tumours in rodents.\(^2\) Associated with leukaemia,\(^11\) melanoma.\(^12\)

**Genotoxicity:** evidence of genotoxicity,\(^13\)\(^-\)\(^14\) including human cells.\(^15\)

**Endocrine disruption:** causes thyroid damage, tumours and altered hormones;\(^2\) associated with hypothyroidism and hyperthyroidism in women,\(^16\) reduces testosterone.\(^17\)

**Reproduction:** in animals: decreases foetal viability;\(^2\) birth defects including hydrocephaly, and in urogenital and skeletal systems;\(^2\) reduced male fertility;\(^17\) damage to testes.\(^18\)\(^-\)\(^20\) In humans: cleft palate,\(^21\) increased length of menstrual cycle, missed periods.\(^22\)

**Immune:** alters immune system response.\(^23\)\(^-\)\(^24\)

**Environmental effects:**

**Aquatic:** highly toxic to fish and aquatic invertebrates;\(^2\) fish kills.\(^2\)

**Terrestrial:** chronic risks to birds and mammals,\(^2\) including reproductive and endocrine; toxic to some beneficial insects.\(^3\)

**Environmental fate:** found in ground and surface waters.\(^2\)
References


