

Guidelines/Criteria	
Reference:	NTP. 1993a. NTP Technical Report on toxicity studies of a chemical mixture of 25 groundwater contaminants. NTP toxicity report series no. 35 - NIH Publication 93-3384. National Toxicology Program, National Institute of Environmental Health Sciences (NIEHS), Research Triangle Park, NC, USA
	Germolec DR, Yang RH, Ackermann MF, Rosenthal GJ, Boorman GA, Blair P, Luster MI. 1989. Toxicology studies of a chemical mixture of 25 groundwater contaminants. II. Immunosuppression in B6C3F1 Mice1. Fundam Appl Toxicol 13:377-387.
In vivo Study Type Route of Administration Species & age of animals	drinking water, water control group B6C3F1 mice, 6-8 weeks old
Study Duration	14 days and 90 days
Type of Mixture Binary >2 components Similar acting or dissimilar What Mode of Action was investigated?	no yes dissimilar action assumed (chemicals mix to simulate groundwater supplies near hazardous dumps) genotoxicity
Parameters/End points Measured Target organs/Critical effects Pharmacological changes or adverse effects	Immunotoxicity (plaque-forming cell response to the T-dependent antigen, sheep red blood cells, NK cell test, Cytotoxic T lymphocytes, lymphocyte enumeration, progenitor cell formation, host resistance assays water consumption, body, liver, spleen, kidney, thymus weights, histopathology of lung, heart, liver, kidney, adrenal glands, spleen thymus, stomach, uterus, bone marrow (sternum), urinary bladder, small and large intestines) adverse
Individual Components Characterisation of individual compounds Name, exact chemical name, CAS no. Were dose responses established for individual components? Were no effect levels established? Were doses below the NO(A)ELs investigated?	yes One mixture was investigated: Acetone, Aroclor 1260, Arsenic, Benzene, Cadmium, Carbon tetrachloride, Chloroform, Chlorobenzene, Chromium, 1,1-Dichloroethane, 1,1-Dichloroethylene, 1,2-Dichloroethane, 1,2-t-Dichloroethylene, Di(2-ethylhexyl)phthalate, Ethylbenzene, Lead, Mercury, Methylene chloride, Nickel acetate tetrahydrate, Phenol, Tetrachloroethylene, Toluene, 1,1,1-Trichloroethane, Trichloroethylen, Xylenes No, only mixtures at four dose levels were administered Yes Yes presumably
Mixtures Investigated Number of dose levels How does the mixture make-up compare to individual components? (e.g. low dose) equivalents used? No. of technical replicates per exposure condition (<i>in vitro</i>) No. of animals per dose group (<i>in vivo</i>)	14-days study (doses: target concentrations and 10- and 100-fold dilutions thereof Target concentrations: Acetone: 106 ppm, Aroclor 1260: 0.02 ppm, Arsenic: 18 ppm, Benzene: 25 ppm, Cadmium: 102 ppm, Carbon tetrachloride: 0.8 ppm, Chloroform: 14 ppm, Chlorobenzene: 0.2 ppm, Chromium: 72 ppm 1,1-Dichloroethane: 2.8 ppm, 1,1-Dichloroethylene: 1 ppm, 1,2-Dichloroethane: 80 ppm, 1,2-t-Dichloroethylene: 5 ppm, Di-2-ethylhexyl-phthalate: 0.03 ppm, Ethylbenzene: 0.6 ppm, Lead: 140 ppm, Mercury: 1 ppm, Methylene chloride: 75 ppm, Nickel: 13.6 ppm, Phenol: 58 ppm, Tetrachloroethylene: 6.8 ppm, Toluene: 14 ppm, 1,1,1-Trichloroethane: 4 ppm, Trichloroethylen: 13 ppm, Xylenes: 3.2 ppm 90-day study (doses: target concentrations and 2- and 10 fold concentrations thereof Target concentrations: Acetone: 53 ppm, Aroclor 1260: 0.01 ppm, Arsenic: 9.0 ppm, Benzene: 12.5 ppm, Cadmium: 51.0 ppm, Carbon tetrachloride: 0.40 ppm, Chloroform: 7.0 ppm, Chlorobenzene: 0.10 ppm, Chromium: 36.0 ppm 1,1-Dichloroethane: 1.4 ppm, 1,1-Dichloroethylene: 0.5 ppm, 1,2-Dichloroethane: 40.0 ppm, 1,2-t-Dichloroethylene: 2.5 ppm, Di-2-ethylhexyl-phthalate: 0.015 ppm, Ethylbenzene: 0.3 ppm, Lead: 70 ppm, Mercury: 0.50 ppm, Methylene chloride: 37.5 ppm, Nickel: 6.80 ppm, Phenol: 29.0 ppm, Tetrachloroethylene: 3.40 ppm, Toluene: 7.0 ppm, 1,1,1-Trichloroethane: 2.0 ppm, Trichloroethylen: 6.50 ppm, Xylenes: 1.60 ppm Would have to be evaluated, NOAELs of individual compounds are not given. not applicable 10 animals/group
Observations/Findings	High dose: Suppression of hematopoietic stem cells and of antigen-induced antibody forming cells. Altered resistance to challenge with an infectious agent Mid and high dose: Suppressed granulocyte-macrophage colony formation. Paired water studies indicate that the immune effects were related to chemical exposure and not to decreased water intake.
Overall opinion (e.g. sufficient numbers of groups investigated, group sizes adequate, observations reproducible, low dose levels used investigated)	Questionable relevance of immuno-parameters investigated. Compare with actual OPPTS Guideline for immunotoxicity study.