

**U.S. EPA Region 9 Biological Technical Assistance Group (BTAG) Recommended Toxicity Reference Values for Mammals (Revision Date 11/21/2002)**

Chemical	Low TRV mg/kg-day	High TRV mg/kg-day	Test Species	Toxic Endpoint(s)	Reference
Aldrin	0.1	1.0	Rat	Neurobehavioral	Paul <i>et al.</i> , 1992
Arsenic	0.32	-	Rat	Growth, cancer, serum chemistries	Schroeder <i>et al.</i> , 1968
	-	4.7	Rat	Kidney, pulmonary	Brown <i>et al.</i> , 1976
Benzo(a)pyrene	1.31	-	Mouse	Cancer	Neal & Rigdon, 1967
	-	32.8	Mouse	Cancer	Neal & Rigdon, 1967
Butyltins	0.25	-	Rat	Reproductive	Smialowicz <i>et al.</i> , 1989
	-	15	Rat	Reproductive	Ema <i>et al.</i> , 1995
Cadmium	0.06	-	Mouse	Reproductive	Webster, 1988
	-	2.64	Mouse	Reproductive	Schroeder & Mitchener, 1971
Cobalt	1.2	-	Rat	Reproductive	Domingo <i>et al.</i> , 1985
	-	20	Rat	Reproductive	Mollenhauer <i>et al.</i> , 1985
Copper	2.67	-	Mouse	Immunotoxicity	Pocino <i>et al.</i> , 1991
	-	632	Mouse	Mortality, growth, water consumption	Hebert <i>et al.</i> , 1993
DDT and Metabolites	0.8	16	Rat	Reproductive	USEPA (Great Lakes), 1995
Heptachlor	0.13	-	Rat	Reproductive	Shain <i>et al.</i> , 1977
	-	6.8	Rat	Developmental	Narotsky <i>et al.</i> , 1995
Lead	1.0	-	Rat	Kidney	Fowler <i>et al.</i> , 1980
	-	241	Mouse	Growth, liver, kidney	Wise, 1981
Lindane	0.05	-	Rat	Reproductive	Naishtein & Leibovich, 1971
	-	3.75	Mouse	Developmental	Sircar & Lahiri, 1989
Manganese	13.7	-	Mouse	Reproductive	Gray & Laskey, 1980
	-	159	Mouse	Reproductive	Gray & Laskey, 1980
Mercury	0.027	0.27	Mink	Mortality, anorexia, neurological	USEPA (Great Lakes), 1995
	0.25	-	Rat	Reproductive, developmental	USEPA (Great Lakes), 1995
	-	4.0	Rat	Reproductive, developmental	USEPA (Great Lakes), 1995
Methoxychlor	2.5	50	Rat	Reproductive	Gray <i>et al.</i> , 1989
Naphthalene	50	-	Rat	Developmental	Navarro <i>et al.</i> , 1991
	-	150	Rat	Developmental	Navarro <i>et al.</i> , 1991
Nickel	0.133	31.6	Rat	Reproductive	Smith <i>et al.</i> , 1993
PCBs	0.36	-	Mouse	Reproductive	Simmons & McKee, 1992
	-	1.28	Mouse	Reproductive	Linzey, 1987
Selenium	0.05	-	Mouse	Liver	Harr <i>et al.</i> , 1967
	-	1.21	Mouse	Reproductive	Schroeder & Mitchener, 1971
Thallium	0.48	1.43	Rat	Hair loss	Downs <i>et al.</i> , 1960
Zinc	9.60	-	Mouse	Pancreas, adrenal cortex	Aughey <i>et al.</i> , 1977
	-	411	Rat	Developmental	Schlicker & Cox, 1968

## REFERENCES

- Aughey et al., 1977. The effects of oral zinc supplementation in the mouse. *Journal of Comparative Pathology*, 87:1-14.
- Brown et al., 1976. Intracellular effects of chronic arsenic administration on renal proximal tubule cells. *Journal of Toxicology and Environmental Health*, 1:505-514.
- Domingo et al., 1985. Effects of cobalt on postnatal development and late gestation in rats upon oral administration. *Revista Española de Fisiología*, 41:293-298.
- Downs et al., 1960. Acute and sub-acute toxicity studies of thallium compounds. *Industrial Hygiene Journal*, 21:399-406.
- Ema et al., 1995. Comparative developmental toxicity of butyltin trichloride, dibutyltin dichloride and tributyltin chloride in rats. *Journal of Applied Toxicology*, 15(4):297-302.
- Folwer et al. 1980. Chronic low-level lead toxicity in the rat. III. An integrated assessment of long-term toxicity with special reference to the kidney. *Toxicology and Applied Pharmacology*, 56(1):59-77.
- Gray & Laskey, 1980. Multivariate analysis of the effects of manganese on the reproductive physiology and behavior of the male house mouse. *Journal of Toxicology and Environmental Health*, 6:861-867.
- Gray et al., 1989. A dose-response analysis of methoxychlor-induced alterations of reproductive development and function in the rat. *Fundamentals of Applied Toxicology*, 12:92-108.
- Harr et al., 1967. Selenium toxicity in rats. International Symposium on Selenium in Biomedicine 1966 (Oregon State University). Editor: O. H. Muth. Westport, Conn., Avi Pub. Co. 445 p.
- Hebert et al., 1993. Subchronic toxicity of cupric sulfate administered in drinking water and feed to rats and mice. *Fundamental and Applied Toxicology*, 21 461-475.
- Linzey, 1987. Effects of chronic polychlorinated biphenyl exposure on reproductive success of white-footed mice (*Peromyscus leucopus*). *Archives of Environmental Contamination and Toxicology*, 16:455-460.
- Mollenhauer et al., 1985. Effects of dietary cobalt on testicular structure. *Virchows Archiv. B* (Cell pathology including molecular pathology), 49:241-248.
- Naishtein & Leibovich, 1971. Effects of small doses of DDT and lindane and their mixture on sexual function and embryogenesis in rats. *Hygiene and sanitation*, 36:190-195.
- Navarro et al., 1991. Developmental toxicity evaluation of naphthalene (CAS NO. 91-20-3) administered by gavage to Sprague-Dawley (CD) rats on gestation days 6 through 15. Chemistry and Life Sciences, Research Triangle Institute (RTI). Research Triangle Park, NC. RTI Master Protocol Number: RTI-376. December 5.
- Neal & Rigdon, 1967. Gastric tumors in mice fed benzo(a)pyrene: a quantitative study. *Texas Reports on Biology and Medicine*, 13(4):553-557.
- Narotsky et al., 1995. Non-additive developmental toxicity in mixtures of trichloroethylene, di-2-ethylhexyl phthalate, and heptachlor in a 5 x 5 x 5 design. *Fundamental and Applied Toxicology*, 27:203-216.
- Paul et al., 1992. Effects of endosulfan and aldrin on muscle coordination and conditioned avoidance response in rats. *Pharmacology and Toxicology*, 71:254-257.

- Pocino et al., 1991. Influence of the oral administration of excess copper on the immune response. *Fundamental and Applied Toxicology*, 16:249-246.
- Schlicker & Cox, 1968. Maternal dietary zinc and development: Zinc, iron, and copper content of the rat fetus. *Journal of Nutrition*, 92:245-252.
- Schroeder et al., 1968. Germanium, tin, and arsenic in rats: Effects on growth, survival, pathological lesions and life span. *Journal of Nutrition*, 96:37-45.
- Schroeder & Mitchener, 1971. Toxic effects of trace elements on the reproduction of mice and rats. *Archives of Environmental Health*, 23:102-106.
- Shain et al., 1977. The effect of chronic ingestion of selected pesticides upon rat ventral prostate homeostasis. *Toxicology and Applied Pharmacology*, 40:115-130.
- Simmons & McKee, 1992. Alkoxyresorufin metabolism in white-footed mice at relevant environmental concentrations of Aroclor 1254. *Fundamental and Applied Toxicology*, 19:446-452.
- Sircar & Lahiri, 1989. Lindane (gamma-HCH) causes reproductive failure and fetotoxicity in mice. *Toxicology*, 59:171-177.
- Smialowicz et al., 1989. Immunotoxicity of tributyltin oxide in rats exposed as adults or pre-weanlings. *Toxicology*, 57:97-111.
- Smith et al., 1993. Perinatal toxicity associated with nickel chloride exposure. *Environmental Research*, 61:200-211.
- USEPA (Great Lakes), 1995. Great Lakes Water Quality initiative Criteria Documents for the Protection of Wildlife. U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA-820\b-95\008.
- Webster, 1988. Chronic cadmium exposure during pregnancy in the mouse: Influence of exposure levels on the fetal and maternal uptake. *Journal of Toxicology and Environmental Health*, 74:183-192.
- Wise, 1981. Protective action of calcium phytate against acute lead toxicity in mice. *Bulletin of Environmental Contamination and Toxicology*, 27:630-633.

**U.S. EPA Region 9 Biological Technical Assistance Group (BTAG) Recommended  
Toxicity Reference Values for Birds (Revision Date 02/24/09)**

<b>Chemical</b>	<b>Low TRV mg/kg-day</b>	<b>High TRV mg/kg-day</b>	<b>Test Species</b>	<b>Toxic Endpoint(s)</b>	<b>Reference</b>
Arsenic	5.5	22.0	Mallard	Reproductive	Stanley <i>et al.</i> , 1994
Butyltins	0.73	45.9	Quail	Reproductive	Schlatterer <i>et al.</i> , 1993
Cadmium	0.7	-	Wood duck	Kidney histology	Mayack <i>et al.</i> , 1981
	-	1.0	Mallard	Kidney histology	Cain <i>et al.</i> , 1983
	-	10.4 LOAEL Mid-Range Adverse Effect Level	Mallard	Reproductive, multiple systemic effects	Richardson <i>et al.</i> , 1974
Copper	2.3	-	Chicken	Growth	Norvell <i>et al.</i> , 1975
	-	52.3	Chicken	Growth, gizzard erosion	Jensen & Maurice, 1978
DDT and Metabolites	0.009	-	Pelican	Reproductive	USEPA (Great Lakes), 1995
	-	1.5	Mallard	Reproductive	USEPA (Great Lakes), 1995
DDE	-	0.6	Mallard	Reproductive	USEPA (Great Lakes), 1995
Lead	0.014	-	Quail	Reproductive	Edens <i>et al.</i> , 1967
	-	8.75	Chicken	Reproductive	Edens & Garlich, 1983
Manganese	77.6	776	Quail	Neurobehavioral	Laskey & Edens, 1985
Mercury	0.039	-	Mallard	Reproductive	USEPA (Great Lakes), 1995
	-	0.18	Mallard	Mortality, neurological	USEPA (Great Lakes), 1995
Nickel	1.38	-	Mallard	Growth	Cain & Pafford, 1981
	-	56.3	Mallard	Growth	Cain & Pafford, 1981
PCBs	0.09	-	Chicken	Reproductive	Platonow & Reinhart, 1973
	-	1.27	Chicken	Reproductive	Britton & Huston, 1973
Selenium	0.23	0.93	Mallard	Reproductive	Heinz <i>et al.</i> , 1989
Zinc	17.2	172	Mallard	Growth, reproductive, multiple organs	Gasaway & Buss, 1972

## REFERENCES

- Britton & Huston, 1973. Influence of polychlorinated biphenyls in the laying hen. *Poultry Science*, 52:1620-1624.
- Cain & Pafford, 1981. Effects of dietary nickel on survival and growth of mallard ducklings. *Archives of Environmental Contamination and Toxicology*, 10: 737-745.
- Cain et al., 1983. Effects of dietary cadmium on mallard ducklings. *Environmental Research*, 32:286-297.
- Edens & Garlich, 1983. Lead-induced egg production decrease in leghorn and Japanese quail hens. *Poultry Science*, 62:1757-1763.
- Edens et al., 1967. Effect of dietary lead on reproductive performance in Japanese quail, *Coturnix coturnix japonica*. *Toxicology and Applied Pharmacology*, 38:307-314.
- Gasaway & Buss, 1972. Zinc toxicity in the mallard duck. *Journal of Wildlife Management*, 36(4):1107-1117.
- Heinz et al., 1989. Impaired reproduction of mallards fed an organic form of selenium. *Journal of Wildlife Management*, 53(2):418-428.
- Jensen & Maurice, 1978. Effect of Methionine on copper-induced growth depression and gizzard erosion, *Poultry Science*, 57:1530-1532.
- Laskey & Edens, 1985. Effects of chronic high-level manganese exposure on male behavior in the Japanese quail (*Coturnix coturnix japonica*). *Poultry Science*, 64:579-584.
- Mayack, Lynn A., Parshall B. Bush, Oscar J. Fletcher, R.K. Page, and Timothy T. Fendley. 1981. Tissues Residues of Dietary cadmium in Wood Ducks. *Archives of Environmental Contamination and Toxicology*. 10: 637-645.
- Norvell et al., 1975. Effects of Feeding High Levels of Various Copper Salts to Broiler Chickens. University of Missouri, Environmental Trace Substance Center and Extension Division. Proceedings of University of Missouri's 9<sup>th</sup> Annual Conference on Trace Substances in Environmental Health. Memorial Union, University of Missouri-Columbia, Columbia, Missouri. Pgs. 457-463.
- Platonow & Reinhart, 1973. The effect of polychlorinated biphenyls Aroclor 1254 on chicken egg production, fertility, and hatchability. *Canadian Journal of Comparative Medicine*, 37:341-346.
- Richardson et al., 1974. Dietary cadmium and enteropathy in the Japanese quail. *Laboratory Investigation*, 31(6):722-731.
- Schlatterer et al., 1993. Effects of bis(tri-n-butyltin) oxide in Japanese quail exposed during egg laying period: An interlaboratory comparison study. *Archives of Environmental Contamination and Toxicology*, 24:440-448.
- Stanley et al., 1994. Main and interactive effects of arsenic and selenium on mallard reproduction and duckling growth and survival. *Archives of Environmental Contamination and Toxicology*, 26:444-451.
- USEPA (Great Lakes), 1995. Great Lakes Water Quality initiative Criteria Documents for the Protection of Wildlife. U.S. Environmental Protection Agency, Office of Water, Washington, D.C. EPA-820\08-95\008.