The Safety of Chlorine Dioxide – Studies and their results

Study On **Name of Study or Sponsor and** **Information Found at the Following Link(s)**	**Notes about the study**	**NOAEL:** No Observed Adverse Effect Level or is the highest data point at which there was not an observed toxic or adverse effect	**LOAEL:** Low Observed Adverse Effect Level is the lowest data point at which there was an observed toxic or adverse effect	**NOEL:** No Observed Effect Level	**LOEL:** Lowest Observed Effect Level	**Other**
CLO2 WHO Starting at page 12: 16.4.1 General description http://www.who.int/water_sanitation_health/dwq/2edvol2p2e.pdf	16.4.4 Kinetics and metabolism in laboratory animals and humans: Chlorine dioxide is rapidly absorbed from the gastrointestinal tract. No particular organ appears to selectively concentrate the dose following exposure (10). Following oral ingestion by monkeys, chlorine dioxide was rapidly converted into chloride ion and, to a lesser extent, chlorite and chlorate (11). Excretion is mainly via the urine, smaller amounts being excreted in faeces (12). Chlorite was readily absorbed when administered to rats, then randomly distributed throughout the tissues (12). It was transformed mainly into chloride in rats, smaller amounts appearing as unchanged chlorite. Excretion was mainly via the urine, followed by faeces (13). Chlorate was readily absorbed and randomly distributed throughout the tissues of rats	15 mg/kg of body weight per day. This means that the average adult at 62kg could consume 930mg per day				

	(12). It was excreted mainly in the form of chloride in the urine, smaller amounts appearing as chlorite and chlorate.					
CLO2 WHO Starting at page 14 http://www.who.int/water_sanitation_health/dwq/2edvol2p2e.pdf	Monkeys and rats for 8 weeks		10 mg/kg of body weight per day, was the LOAEL			
CLO2 WHO Starting at page 14 http://www.who.int/water_sanitation_health/dwq/2edvol2p2e.pdf	**12 African Green Monkeys for 30 to 60 days**	3.5 mg/kg-day				
CLO2 EPA p.18 http://www.epa.gov/iris/toxreviews/0496tr.pdf	**90 day study in 1990 with rats** Significant reductions in water consumption were observed in the males exposed to $ 50 mg/L and in females exposed to $ 25 mg/L; decreases in food consumption were also observed in the 200 mg/L males. Absolute liver weights were decreased in males at $ 50 mg/L, and absolute spleen weights were decreased in females at $ 25 mg/L. (The above may have been due to dehydration since		2 mg/kg-day (25 mg/L)			

	the rats were drinking less water.)					
CLO2 EPA p.18-19 http://www.epa.gov/iris/toxreviews/0496tr.pdf	**1982 study with Green Monkeys**	3.5 mg/kg-day	9.5 mg/kg-day			
CLO2 EPA p.18 http://www.epa.gov/iris/toxreviews/0496tr.pdf	2 year study in 1949 with rats (It appears that the reason 1.3 mg/kg was used as the NOAEL is because that the next higher amount given to the rats was 13 mg/kg (10 times more) which killed a significant number of the rats in the study – but again, 13mg/kg is a very large amount and is about 7 times more than taking 3 drops of MMS per hour, 8 times a day – for 2 years!	1.3 mg/kg-day				
CLO2 WHO Starting at page 14 http://www.who.int/water_sanitation_health/dwq/2edvol2p2e.pdf	Reproductive toxicity, embryotoxicity, and teratogenicity Female rats were exposed to 0, 1, 10, or 100 mg of chlorine dioxide per litre in drinking-water (equivalent to 0, 0.1, 1, or 10 mg/kg of body weight per day) for 2.5 months before mating and throughout gestation. At the highest dose, there was a slight reduction in the number of implants and live	1 mg/kg				

	births per pregnancy. No effects were observed at 1 mg/kg of body weight per day, which was identified as the NOAEL (18) Note that 1mg is 100 times LESS than 100mg					
CLO2 WHO Starting at page 14 http://www.who.int/water_sanitation_health/dwq/2edvol2p2e.pdf	Female Sprague-Dawley rats (13-16 per dose) were supplied with drinking-water containing 0, 2, 20, or 100 mg of chlorine dioxide per litre from 2 weeks before mating to gestation and lactation until pups were weaned on postnatal day 21. No significant effect on the body weight of either the dams or the pups was observed at any dose tested. At 100 mg/litre (14 mg/kg of body weight per day for the pregnant dam), a significant depression of serum thyroxine and an increase in serum triiodothyronine were observed in the pups at weaning, but not in the dams. Neurobehavioural exploratory and locomotor activities were decreased in pups born to dams exposed to 100 mg/litre but not to those exposed to 20 mg/litre (3 mg/kg of body weight per day), which was considered a NOAEL (19)	3 mg/kg				
Chlorite WHO	Single doses of sodium chlorite administered orally to cats produced methaemoglobinaemia (25). A	1 mg/kg				This low **NOAEL** is a good reason to try to activate as much of the sodium chlorite

Starting at page 15-16 http://www.who.int/water_sanitation_health/dwq/2edvol2p2e.pdf	dose of 20 mg of chlorite per litre (equivalent to approximately 1.5 mg of chlorite per kg of body weight) caused up to 32% of the haemoglobin to be in the methaemoglobin state and was considered to be the LOAEL. A dose-dependent increase in methaemoglobinaemia and anaemia was observed in 12 African green monkeys treated with sodium chlorite at 0, 25, 50, 100, or 400 mg/litre in drinking-water using a rising dose protocol. Doses of chlorite were approximately 0, 3, 6, 13, and 50 mg/kg of body weight per day, and each dose level was maintained for 30-60 days (11). Rats were exposed to chlorite ion at 0, 10, 50, 100, 250, or 500 mg/litre in drinking-water (equivalent to 0, 1, 5, 10, 25, or 50 mg/kg of body weight per day) for 30-90 days. Haematological parameters were monitored, and the three highest concentrations produced transient anaemia. At 90 days, red blood cell glutathione levels in the 100 mg/litre group were 40% below those of controls; there was at least a 20% reduction in the rats receiving 50 mg/litre. In this study, a NOAEL of 1 mg/kg of body weight per day was identified (25)					as possible externally

Chlorite WHO Starting at page 15-16 http://www.who.int/water_sanitation_health/dwq/2edvol2p2e.pdf	In a series of experiments, sodium chlorite was administered to male rats (12 rats per dose) in drinking-water for 66-76 days at concentrations of 0, 1, 10, 100, or 500 mg/litre (equivalent to 0, 0.1, 1, 10, or 50 mg/kg of body weight per day). No compound-related abnormalities were observed on histopathological examination of the reproductive tract. Abnormal sperm morphology and decreased sperm motility were seen at the two highest dose levels, but no sperm effects were observed at 1 mg/kg of body weight per day, which can be identified as the NOAEL. In another part of the same study, male rats were bred with female rats treated at the same dose levels for 2 weeks before and throughout a 10-day breeding period. Females were exposed to sodium chlorite throughout gestation and lactation until the pups were weaned on day 21. There was no evidence of any adverse effects on conception rates, litter size, day of eye opening, or day of vaginal opening. Based on reproductive effects, a NOAEL of 10 mg/kg of body weight per day, the highest dose tested, was identified (26)	1 mg/kg & 10mg/kg				This low **NOAEL** is a good reason to try to activate as much of the sodium chlorite as possible externally