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New aspects in deriving health based guidance values for bromate in swimming pool water

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Question: Bromate classified as 1B carcinogen is a typical by-product occurring in drinking and swimming pool water after disinfection. The aims of this study were a) to re-evaluate the carcinogenic mode of action of bromate, b) to derive reliable levels of exposure by all routes under various scenarios of swimming, and c) to inform the derivation of cancer risk-related bromate concentrations in swimming pool water.

Methods: A comprehensive literature search was performed. Quality of the studies on genotoxicity and carcinogenicity were assessed by Klimisch criteria (Klimisch et al. 1997) and SciRAP tool (Beronius et al. 2018), respectively. Benchmark dose (BMD) modelling was performed using the modelling average mode in BMDS 3.1 and PROAST 66.40 (human cancer BMDL10; EFSA 2017). For the exposure, data from a wide range of sources were evaluated for their reliability. Different target groups (infants/toddlers, children and adults) and exposure scenarios (recreational, sportive swimmers, top athletes) were considered for oral, inhalation and dermal exposure. Exposure was calculated by frequency of swimming events and duration in water.

For illustration, cancer risk-related bromate concentrations in pool water were calculated for different target groups taking into account their exposure, using the hBMDL10 and a cancer risk of 10-5.

Results: There is convincing evidence from a multitude of studies that bromate induces clastogenic and aneugenic effects as well as oxidative DNA damage and DNA strand breaks formation *in vitro* and *in vivo* without discernible threshold. Hence, bromate may be considered a non-threshold carcinogen.

BMD modelling with model averaging for renal cancer studies (Kurokawa et al. 1983, 1986; DeAngelo et al. 1998) resulted in a median hBMDL10 of 0.65 mg BrO3-/kg bw per day.

Evaluation in different age and activity groups revealed that top athletes had the highest exposure, followed by sportively active children, sportively active adults, infants and toddlers, children and adults. The predominant route of exposure was oral (73 - 98%, by swallowing water, followed by the dermal route (2 - 27%); inhalation route was insignificant (< 0.5%).

Conclusions: Accepting the same risk level for all population groups results in different guidance values due to the large variation in exposure. For example, for an additional risk of 10-5 the bromate concentrations would range between 0.011 for top athletes, 0.015 for sportive children and 2.1 mg/l for adults.