A scientific approach for proposing chemical exposure limits in saturation diving

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Chemical contamination in the working atmosphere of a saturation diver may represent a greater threat than similar conditions onshore since the diver cannot easily escape the exposure. Health effects with limited impact onshore may have serious consequences for a diver at the sea bottom. In addition, both hyperoxia that is an inevitable part of all diving and the continuous exposure during saturation diving may infer long-term effects of chemicals at lower concentrations than in a normal working environment. At present, divers are protected against chemicals in the breathing atmosphere by standard exposure limits only adjusted for the increased exposure length, i.e. from 8 to 24 hrs a day and from 5 to 7 days a week. The objective of the present study was to indicate a procedure for derivation of occupational exposure limits specific for saturation diving, termed hyperbaric exposure limits (HEL).

Using benzene as an example a procedure is outlined that includes identification of the latest key documents describing toxicology, risk assessments and suggestion for exposure limits at normal conditions. Moreover, the procedure includes extensive literature search with a defined search string and with clearly defined exclusion criteria for the literature retrieved. Hematotoxicity and leukemia were defined as the critical effects, and exposure limits based upon concentration and cumulative exposure data and corresponding risks of leukemia were calculated. For comparison with a normal working schedule onshore the cumulative exposure time expressed as working-years was calculated for a typical saturation diver's career and compared to the cumulative exposure for onshore workers. Possible interactions of conditions specific for saturation diving, i.e. high pressure, effects of elevated pO_2 and the continuous exposure have been assessed and incorporated in a final suggestion of a HEL for benzene. The procedure should be applicable for chemicals possibly found as contaminants in the divers' breathing atmosphere.