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Suprathreshold intensity and annoyance reactions in experimental challenge to toluene and n-butyl acetate among subjects with long-term solvent exposure.

Ørbæk P, Österberg K, Åkesson B, Bergendorf U, Karlson B, Seger L

Objectives This study explores reactions to low-level chemical challenge, aiming at the development of test procedures for assessing individual sensitivity to smells and chemicals.

Methods Subjects with symptoms and neuropsychological test results compatible with toxic encephalopathy type 2A (TE-2A) and 2B (TE-2B) and unexposed referents (N=12 in each group) were challenged in an exposure chamber. Toluene exposure was started at 11 mg/m$^3$, and it followed a geometric progression scale with a ratio of 2, until reaching 180 mg/m$^3$. In a counterbalanced design, the subjects were similarly exposed to n-butyl acetate starting at a concentration of 14 mg/m$^3$ and increasing to 228 mg/m$^3$. At each exposure level, smell intensity was measured on a 7-step category scale. Mucous membrane irritation and annoyance reactions were rated on visual analogue scales.

Results Both TE groups showed high sensitivity to the low-level solvent challenge, which provoked immediate annoyance and fatigue reactions. In particular the TE-2B group related smell intensity to various annoyance dimensions during exposure to n-butyl acetate, a pattern not observed during toluene exposure. The reference group clearly separated smell intensity and annoyance reactions in both exposure conditions.

Conclusion The reaction of the TE cases suggests that chemical sensitivity can be distinguished from normal annoyance reactions by the inability to differentiate between smell intensity and an experience of irritation from mucous membranes in air concentrations well below the trigeminal irritation threshold level. Fatigue coreactivity in challenges to single substances below the neurotoxic level may also be important.