

TABLE 4.—SUMMARY OF PROPOSED AEGL VALUES FOR BROMINE [PPM (MG/M³)]—Continued

Classification	10-minutes	30-minutes	1-hour	4-hours	8-hours	Endpoint (Reference)
AEGL-3 (Lethal)	19 (124)	12 (78)	8.5 (55)	4.5 (29)	3.2 (21)	Schlagbauer and Henschler 1967

ii. *References.* a. Bitron, M.D. and E.F. Aharonson. 1978. Delayed mortality of mice following inhalation of acute doses of CH₂, SO₂, Cl₂, and Br₂. *American Industrial Hygiene Association Journal*. 39:129–138.

b. Elkins, H.B. 1959. Inorganic compounds: Bromine. *Chemistry of Industrial Toxicology*. John Wiley & Sons, New York. p. 89.

c. Rupp, H. and D. Henschler. 1967. Effects of low chlorine and bromine concentrations in man. *Internationales Archiv fuer Gewerbepathologie und Gewerbehygiene*. 23:79–90.

d. Schlagbauer, M. and D. Henschler. 1967. Inhalation toxicity of chlorine and bromine with single and repeated exposures. *Internationales Archiv fuer Gewerbepathologie und Gewerbehygiene*. 23:91–98.

4. *Chloroacetic acid*—i. *Description.* Monochloroacetic acid (MCAA) is a colorless crystalline material, which is highly soluble in water and soluble in organic solvents. Its vapor pressure at room temperature is moderate with reported values between 0.2 hPa (crystalline substance) and 10 hPa (solution in water). MCAA has a pungent odor.

MCAA is produced by chlorination of acetic acid or hydrolysis of trichloroethene using sulfuric acid. The world production capacity was estimated at 362,500 tons/year in 1987. MCAA or its sodium salt, sodium monochloroacetate, are used primarily in the industrial production of carboxymethylcellulose, herbicides, thioglycolic acid as well as in the production plastics, pharmaceuticals, flavors, cosmetics, and other organic chemicals.

MCAA is an acid (pK_a 2.85) and therefore can cause eye and skin

irritation upon contact with a diluted MCAA solution and skin corrosion and conjunctival burns upon contact with more concentrated solutions. The systemic toxicity of MCAA is caused by inhibition of enzymes of the glycolytic pathway and the tricarboxylic acid cycle. This metabolic blockage damages organs with a high energy-demand, such as heart, central nervous system (CNS), and muscles, and leads to metabolic acidosis due to the accumulation of lactic acid and citric acid in the body.

No studies are available reporting severe toxic effects in humans after inhalation exposure to MCAA. Mortality was reported in a child after oral uptake of 5–6 ml of an 80% MCAA solution (Rogers, 1995). Several lethal accidents have been reported, in which workers were dermally exposed to hot, liquid MCAA. An inadequately described study reported an irritation threshold of 1.48 ppm (Maksimov and Dubinina, 1974); no respiratory tract irritation, effects on lung function parameters or irritation of skin and mucous membranes were reported for >33 workers potentially exposed to MCAA concentrations between <0.13 ppm for 3 hours and 0.31 ppm for 7 hours (Clariant GmbH, 2000).

The only animal study reporting lethal effects after inhalation exposure was an inadequately described study in which a LC₅₀ of 46.8 ppm for 4 hours was reported for rats (Maksimov and Dubinina, 1974). Several studies report lethal effects after oral exposure with LD₅₀ values mostly between 50–200 mg/kilogram (kg) for rats, mice and guinea pigs. In a single inhalation experiment on rats, eye squint and slight lethargy were observed during exposure to an analytical concentration of 66 ppm for 1 hour (Dow Chemical Co., 1987). In an

inadequately reported study, an irritation threshold in rats of 6.16 ppm and a no-observed-effect-level (NOEL) for histological changes in the respiratory tract in rats and guinea pigs of 1.5 ppm after 4 months have been reported (Maksimov and Dubinina, 1974).

No relevant studies of adequate quality were available for the derivation of the AEGL-1. Therefore, due to insufficient data, AEGL-1 values were not derived.

The AEGL-2 was based on a single inhalation study in rats (Dow Chemical Co., 1987) in which eye squint and lethargy were observed in rats exposure to 66 ppm for 1 hour. A total uncertainty factor of 10 was used. A factor of 3 was applied for interspecies variability because the effect level was considered below that of an AEGL-2 and because the available data do not point at a large interspecies variability for more severe (lethal) effects. A factor of 3 was applied for intraspecies variability because a higher factor was not considered adequate on the basis of a comparison with human data for oral exposure. The other exposure duration-specific values were derived by time scaling according to the dose-response regression equation Cⁿ × t = k, using the default of n = 3 for shorter exposure periods and n=1 for longer exposure periods, due to the lack of suitable experimental data for deriving the concentration exponent.

No relevant studies of adequate quality were available for the derivation of the AEGL-3 value. Therefore, due to insufficient data and the uncertainties of a route-to-route extrapolation, AEGL-3 values were not derived.

The proposed AEGL values are listed in Table 5 of this unit.

TABLE 5.—SUMMARY OF PROPOSED AEGL VALUES FOR MONOCHLOROACETIC ACID ^A

Classification	10-minutes	30-minutes	1-hour	4-hours	8-hours	Endpoint (Reference)
AEGL-1 (Nondisabling)	Insufficient data (I.D.)	I.D.	I.D.	I.D.	I.D.	I.D.
AEGL-2 (Disabling)	12 ppm (47 mg/m ³)	8.3 ppm (33 mg/m ³)	6.6 ppm (26 mg/m ³)	1.7 ppm (6.7 mg/m ³)	0.83 ppm (3.3 mg/m ³)	Eye squint and lethargy in rats (Dow Chemical Co., 1987)
AEGL-3 (Lethal)	I.D.	I.D.	I.D.	I.D.	I.D.	I.D.

^a Skin contact with molten MCAA or MCAA solutions should be avoided; dermal penetration is rapid and fatal intoxications have been observed when 10% or more of the body surface was involved.