

*Recommendation from Scientific Expert Group
on Occupational Exposure Limits
for Metallic Silver*

8 hour TWA	:	0.1 mg/m ³
STEL (15 mins)	:	-
Additional classification	:	-

Substance:

Metallic silver	Ag	
Synonyms	:	Algaedyn, argentum (crede), CI 77820
EINECS N°	:	231-131-3
EEC N°	:	- Classification : -
CAS N°	:	7440-22-4
Atomic wt	:	107.87

Conversion factor : Not appropriate

Occurrence/use:

Silver is a white, moderately soft metal. It has a MPt of 961°C, a BPt in the region of 2000°C and a vapour pressure of 0.10 Pa at 840°C. It therefore exists only in the solid phase under occupational exposure conditions.

Silver occurs predominantly in ores such as argentite (Ag₂S), but also in its pure form. The world production rate is in excess of 10,000 tonnes per annum. It is used in production of silver compounds, for coating, as a catalyst or steriliser, or in alloys with many other metals.

Health Significance:

There is evidence for absorption of metallic silver through the lungs (Rosenman *et al*, 1979, Divincenzo *et al*, 1985) and intestine (Smith and Carson, 1977), although the data are not quantitative. Acute toxicity data are not available for metallic silver.

The main chronic effect of silver exposure is argyria, a grey blue discolouration of skin, eyes, nails, mucous membranes and/or internal organs. Local argyria may result from dust of metallic silver or aerosols of silver salts; systemic argyria is observed after ingestion of silver compounds only. Local argyrosis, as deposition in the conjunctivae of the eyes, seems to be the most sensitive effect (Buckley *et al*, 1965, Rungby, 1986; Green and Su, 1987). These are irreversible effects, but they are cosmetic rather than damaging to health. The majority of occupational exposure reports concern silver salts, which appear to cause effects at lower concentrations than metallic silver (Wölbling *et al*, 1988). There is no animal model for these effects.

Argyrosis has been observed in workers exposed to silver compounds at concentrations in the range of 0.005-0.38 mg/m³ (Rosenman *et al*, 1979; Rosenman *et al*, 1987; Pifer *et al*, 1989; Wölbling *et al*, 1988). Perrone *et al* (1977) observed 4 argyria of the eye cases in workers exposed to an estimated concentration of 0.022 mg/m³ (respirable dust)/0.31 mg/m³ (total dust) of metallic silver; it is doubtful whether these concentrations are representative of actual exposure because just one sample was taken at a location not identical with the exposure place of the 4 observed argyria cases. Wölbling observed no cases of argyria in a group of workers exposed primarily to metallic silver at concentrations of 0.003 - 0.54 mg/m³ metal silver dust in a cohort of 50 workers.

Recommendation:

Total dust is more indicative than respirable dust for local argyrosis in the conjunctivae of the eyes. The data of Rosenman *et al*. (1979, 1987), Perrone *et al*. (1977) and Wölbling *et al*. (1988) together indicate a threshold in the range of 0.2 - 0.5 mg/m³ total silver dust. Since no extended analytical determinations were performed in these studies, an uncertainty factor of 2-5 was applied. The recommended 8-hour TWA is 0.1 mg/m³. No STEL was considered necessary.

At the levels recommended, no measurement difficulties are foreseen.

Bibliography:

Principle reference

SEG/CDO/23A (1992). Criteria document for an occupational exposure limit value for metallic silver. Prepared by Department of Toxicology, University of Nijmegen, Netherlands.

Key Studies

Buckley, W.R., Oster, C.F. and Fassett, D.W. (1965). Localised argyria. II. Chemical nature of the silver containing particles. *Arch. Dermatol.* 92, 697-705.

DiVencenzo, G.D., Giodano, C.J. and Schriever, L.S. (1985). Biologic monitoring of workers exposed to silver. *Int. Arch. Occup. Environ. Health* 56, 207-215.

Greene, R.M. and Su, W.P.D. (1987). Argyria. *Am. Fam. Phys.* 36, 151-154.

Perrone, S., Clonfero, E., Gori, G. and Simonato, L. (1977). Four case studies of occupational argyrosis (Italian)? *Medicina del lavoro, Milano, Italy* 68, 178-186.

Pifer, J.W., Friedlander, B.R., Kintz, R.T. and Stockdale, D.K. (1989). Absence of toxic effects in silver reclamation workers. *Scand. J. Work. Environ. Health* 15, 210-221.

Rosenman, K.D., Moss, A. and Kon, S. (1979). Argyria: clinical implications of exposure to silver nitrate and silver oxide. *J. Occup. Med.* 21, 430-435.

Rosenman, K.D., Seixas, N. and Jacobs, I. (1987). Potential nephrotoxic effects of exposure to silver. *Br. J. Ind. Med.* 44, 267-272.

Rungby, J. (1986). Experimental argyrosis: ultrastructural localization of silver in rat eye. *Exp. Mol. Pathol.* 45, 22-30.

Smith, I.C. and Carson, B.L. (1977). Silver: an appraisal of environmental exposure. NIEHS, Res. Triangle Park, N. Carolina, USA.

Wölbling, R.H., Milbradt, R., Schopenhauer-Germann, E., Euler, G. and König, K.H. (1988).
Argyrosis in employees of the silver-processing industry. *Arbeitsmed. Sozialmed. Präventivmed.*
23/12, 293-297.