

## Dichloromethane and the Montreal Protocol

Dichloromethane (DCM) or Methylene Chloride is a chlorinated hydrocarbon produced on a large industrial scale for almost 100 years. It is not only an industrial chemical but is also produced as a result of natural bio-production with relevant emissions to the atmosphere. DCM is produced as a coproduct with other chloromethanes such as Methyl Chloride and Chloroform. In the western world DCM is intentionally produced for dedicated uses, while in Asia, particularly China, the DCM production is driven by chloroform production. This Chloroform is used to produce HFC-22 which is an intermediate for the production of fluoropolymers (use of HFC-22 as refrigerant is to be phased out by 2030).

Dichloromethane is a highly volatile liquid (VOC) with a short atmospheric lifetime of only 0.4 years. It is therefore considered as a Very Short Lived Substance (VSLS), as defined by UNEP, with an ozone depleting potential (ODP) of  $\approx 0$ .

DCM has a negligible effect on stratospheric ozone. It is proven that there is minimum transport of DCM from northern hemisphere to southern hemisphere via the stratosphere due to the short atmospheric lifetime. Consequently DCM that does get into the stratosphere decomposes rapidly by photolysis in the lower stratosphere. The contribution of anthropogenic and natural DCM emissions to the overall total stratospheric chlorine in total is less than 1 %.

Globally, applications of Dichloromethane include the use as an extraction solvent for food and pharmaceutical production, as a solvent for metal degreasing and paint stripping, as a blowing agent for PU foams and as feedstock for HFC-32. DCM has been used in Europe for many years, usually in closed systems due to strict regulations such as the industrial emission regulation, REACH and other legislations. Control of emissive uses in developing countries has started to be implemented, e.g. China has started to regulate environmental pollution with the priority substances listing.

Recently there have been publications (for ex. Hossaini et al, ) discussing the effect of DCM on the stratospheric ozone postulated predictions of a high future growth rate of DCM production and emissions: e.g. they use growth rates in the three year period from 2011 to 2013, and then extrapolate them for 37 years. Not only are such extrapolations statistically questionable and unsupported, they also have no commercial or technical rationale. In reality the global DCM production capacity in the last 5 years has remained stable after a significant increase of capacity of DCM in China between 2005 and 2011. This is supported by the stagnating measured global emissions since 2013 (Ref. A. McCullough 2017). In future a decline of emissions from emissive uses is expected due to less co-production and increased regulation in developing countries.

**In summary regulating DCM under the Montreal Protocol will not bring benefits to the ozone layer. The current contribution to the overall stratospheric chlorine is already very low and expected to decrease due to stagnation/decline in future DCM production and increased and tighter emission control regulations.**

Reference (A. McCullough Dichloromethane in the Environment 2017)