APPENDIX B. Air Concentration Calculations for Comparison to OSHA Standards

OSHA Permissible Exposure Limits (PEL) are set on the basis of mass of toxic substance per unit volume of air at ambient conditions. Therefore, the OSHA PEL in mg/m^3 is absolutely fixed and not subject to corrections for temperature and pressure. This constraint implies that volume concentration of gases in parts per million (ppm) must be with reference to some defined temperature and pressure; these are NTP (25 °C and 760 mm Hg) in the OSHA PEL limit.

The following formulae, therefore, must be used in calculations comparing analytical results to OSHA PEL. Each of the methods in this Manual uses a similar calculation.

Physical Form of Substance Sampled	Unit of Air Concentration	Formula for Direct Comparison With OSHA PEL Table
Gas	ppm	$C_v = \dfrac{m \cdot 10^3}{V} \cdot \dfrac{24.46}{MW}$
Gas	mg/m3	$C = \dfrac{m \cdot 10^3}{V}$
Aerosol	mg/m^3	$C = \dfrac{m \cdot 10^3}{V}$

where: m = actual mass of substance, in mg, found on the sampling device
V = air volume, L, taken at the sampling site, ambient temperature and pressure
24.46 = the volume (L) of 1 mole of gas at 25 °C and 760 mm Hg
C_v = air concentration, ppm by volume, at 25 °C and 760 mm Hg
C = air concentration, mg/m^3
MW = molecular weight, grams/mole

Example: A personal sampling pump is calibrated at 25 °C and 630 mm Hg, and then used to sample air at 20 °C and 660 mm Hg for 60 min at a flow rate of 1.00 L/min. The analytical lab reports 0.188 mg of allyl chloride (MW 76.5) in the sample. What is the air concentration relative to the OSHA PEL?
NOTE: If the sampling pump uses a rotometer for flow rate indication, the calibrated flow rate must be corrected for the actual air pressure and temperature during sampling. (See formula on p. 26.) In this example the pump does not use a rotameter, so the calibrated flow rate is used.

Solution: Concentration of allyl chloride, for comparison with the OSHA PEL, is:

$$C_v = \frac{0.188 \cdot 1000}{60} \cdot \frac{24.46}{76.5} = 1.0 \text{ ppm}$$

or

$$C = \frac{0.188 \cdot 1000}{60} = 3.13 \text{ mg/m}^3$$

These values indicate that the concentration of allyl chloride is at the OSHA PEL.