



Calibration of Dissolved Noble Gas Mass Spectrometric Measurements by an Air-Water Equilibration System

Darren Hillegonds, Takuya Matsumoto, Manfred Jaklitsch, Liang-Feng Han, Philipp Klaus, Leonard Wassenaar, and Pradeep Aggarwal

International Atomic Energy Agency, Vienna, Austria

Precise measurements by mass spectrometry of dissolved noble gases (He, Ar, Ne, Kr, Xe) in water samples require careful calibration against laboratory standards with known concentrations. Currently, air pipettes are used for day-to-day calibrations, making estimation of overall analytical uncertainties for dissolved noble gas measurements in water difficult. Air equilibrated water (AEW) is often used as a matrix-equivalent laboratory standard for dissolved gases in groundwater, because of the well-known and constant fractions of noble gases in the atmosphere. AEW standards, however, are only useful if the temperature and pressure of the gas-water equilibrium can be controlled and measured precisely (i.e. to better than 0.5%); contamination and partial sample degassing must also be prevented during sampling.

Here we present the details of a new custom air-water equilibration system which consists of an insulated 600 liter tank filled with deionized water, held isothermally at a precise target temperature (<0.05 °C) through the use of a heat exchanger. The temperature and total dissolved gas of the water in the tank are monitored continually, as are atmospheric pressure and air temperature in the laboratory. Different noble gas concentration standards can be reliably produced by accurately controlling the water temperature of the equilibration system. Equilibration characteristics and reproducibility of this system for production of copper tubes containing known amounts of noble gases will be presented.