

Quantitative Gas Transfer for Re-Establishing Gaseous Source Measurements at NIST

Max Carlson¹, Brittany A. Broder¹, Richard Essex², Ryan Fitzgerald¹, Brian Zimmerman¹

¹*Radiation Physics Division, National Institute of Standards and Technology, Gaithersburg, MD, 20899*

²*Department of Energy, Germantown, MD, 20874*

Radioactive gas standards are critical to ensuring accurate measurements in fields such as environmental monitoring, nonproliferation testing, and medical imaging. While gas calibration services at NIST have been offline for several years, recent interest has prompted the re-development of a length-compensated proportional gas counting (LCPC) system. The gas counting system consists of a set of three gas filled, electrically biased, cylindrical chambers. Potential loss of counting efficiency near the ends of the chambers is accounted for by using multiple counters of varying length; the volumes are subtracted from each other to observe the net activity per volume without end effects. Compared to the original system in 1970, the presently used version adds spectroscopic capabilities.

The main components of the gas handling system have been assembled, and work is underway to calibrate volumes and to validate a protocol for quantitatively transferring and measuring gas in this system. To measure activity concentration, the amount of a source gas inside each counter tube is calculated based on known volumes and pressures. A technique for mixing source gas and counting gas, and transferring the mixture into the counters, without the use of cryogenic condensation is developed. The gas mixture is expanded into a manifold containing the proportional counters, where the gas flows into the counters through baffles. As the source decays in the counters, charge multiplication with the counting gas creates a signal that is read out through a central wire. Preliminary measurements using this system are underway with Kr-85.

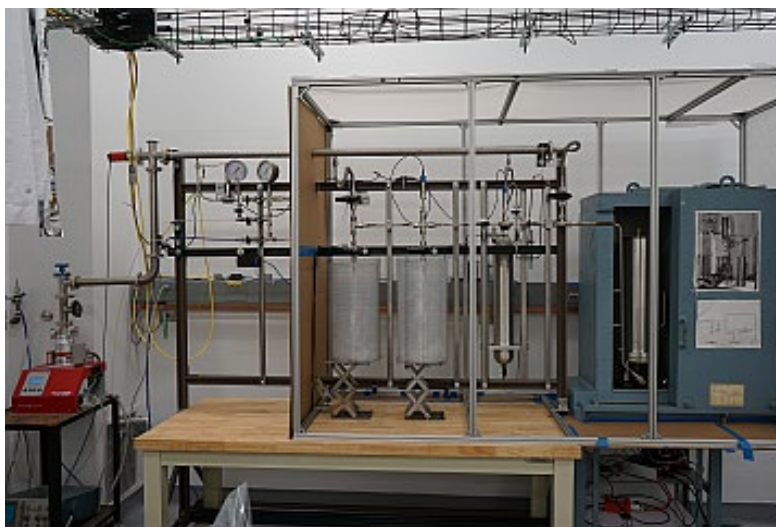


Figure 1: Photograph of gas handling system at NIST.