BINGHAM RESEARCH CENTER · UTAH STATE UNIVERSITY

Mercury Permeation Tubes

Permeation tubes built and characterized at the Bingham Research Center, available separately from our calibrator. Each tube's emission rate is established gravimetrically against SI-traceable mass standards, making these the only permeation standards demonstrated to support independent, SI-traceable calibration of mercury measurements in the field.

Hg^0, $HgBr_2$, $HgCl_2$	SI-traceable	7–10%
COMPOUNDS AVAILABLE	GRAVIMETRIC VERIFICATION	EXPANDED UNCERTAINTY

Specifications

Construction: PTFE Teflon tubing with PTFE end plugs, holding high-purity elemental mercury or crystalline mercury halide. Permeable length and wall thickness are set to the emission rate your application needs.

Gravimetric characterization: emission rate determined by regression of mass loss over repeated weighings on a 1 µg microbalance, verified against SI-traceable mass standards before every weighing.

Speciation verified: permeated mercury is analyzed by gas chromatography–mass spectrometry to confirm the fraction emitted as oxidized mercury rather than assuming it from the tube contents.

Stated uncertainty: expanded uncertainty of the gravimetric permeation rate was 7% for elemental mercury and 10% for $HgBr_2$ in published work.

Documentation: each tube has a unique identification number and RFID tag and is delivered with its own permeation rate data and characterization conditions.

Verified against blanks: mercury-free tubes of identical construction emit less than 0.01% of a loaded tube, giving a true system blank.

Why these tubes

The only SI-traceable route to field calibration

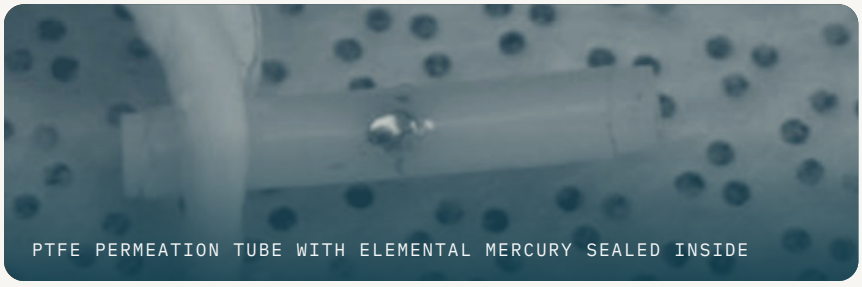
Tubes of this design produced the first oxidized mercury measurements verified against an SI-traceable calibration in field conditions while sampling ambient air.

Measured, not assumed

Emission rates come from mass loss on a balance checked against certified standards, so the rate carries a stated uncertainty rather than a nominal manufacturer value.

Confirmed by independent methods

Rates and speciation have been compared against gas chromatography–mass spectrometry and against cold vapor atomic fluorescence calibrated to NIST 3133. All methods agreed within their uncertainties.



PTFE PERMEATION TUBE WITH ELEMENTAL MERCURY SEALED INSIDE

Proven performance

These are the permeation standards behind the first SI-traceable calibrations of gas-phase oxidized mercury measurements, and the only method for field-ready, ambient-level, independent calibration of elemental mercury. Results were published by **Elgiar et al.** in *Environmental Science & Technology* (2024), showing that elemental and oxidized mercury permeation tubes of this design held stable emission rates through months of remote field use and laboratory verification.

Tubes are produced at Utah State University's **Bingham Research Center** and are already in use by commercial instrument developers.

Interested in ordering permeation tubes?

Bingham Research Center, Utah State University

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