U. S. Department of Commerce
Malcolm Baldrige
Secretary

National Bureau of Standards
Ernest Ambler, Director

National Bureau of Standards

Certificate of Analysis

Standard Reference Material 955

Lead in Blood

This Standard Reference Material (SRM) is intended primarily for use in evaluating the accuracy of lead determinations in blood and in calibrating the instrumentation used in these determinations. SRM 955 consists of four levels of lead in porcine blood.

The certified concentrations of lead, and their associated uncertainties are shown below. The uncertainties are expressed as two standard deviations of the mean and include allowances for between-bottle variability.

	Lead Concentration at 22 °C	
Code	μg/dL	μmol/L
A	5.7 ± 0.5	0.27 ± 0.02
B	30.5 ± 0.3	1.47 ± 0.02
C	49.4 ± 0.8	2.38 ± 0.04
D	73.2 ± 0.7	3.53 ± 0.03

Use: Before use, a frozen sample should be allowed to thaw at room temperature. The sample should be mixed by gently rolling, not shaking, the bottle to remix any water which separated on freezing. Shaking will cause bubbles to form at the top of the sample.

For a certified concentration to be applicable to an analytical determination, a minimum sample of 100 μL must be used.

Notice and Warnings to Users:

Expiration of Certification: This certification is invalid after one year from the date of shipping. Should it become invalid before then, purchasers will be notified by NBS.

Storage: The materials should be kept in their original bottles and stored frozen at -20 °C in the plastic box and aluminized bag. Frost-free freezers should not be used because of temperature fluctuations.

Analyses were performed by D. Mo (NBS Guest Worker), T.J. Murphy, P.J. Paulsen, T.C. Rains, and M.E. Watson; density determinations by L. Sniegoski.

Statistical consultation was provided by R.C. Paule of the National Measurement Laboratory, NBS.

The overall direction and coordination of the analyses were under the chairmanship of D.J. Reeder.

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by R. Alvarez.

Gaithersburg, MD 20899
December 18, 1984

Stanley D. Rasberry, Chief
Office of Standard Reference Materials

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Preparation and Analysis

The source of blood for this reference material was from hogs used in nutrition studies at the U.S. Department of Agriculture, Beltsville, Maryland. At the conclusion of the studies, hogs were fed various levels of lead acetate in their diet for a period of three weeks. Three days after the final feeding, blood from the hogs was collected directly into clean Teflon containers. Heparin was used as the anticoagulant. The blood was then subjected to repeated freeze-thawing, followed by flow-through sonication to assure complete rupture of the red cells. The blood was then stored frozen for several years while stability studies were performed.

Finally, selected lots of blood from different animals were blended to provide the four levels of lead. The pooled blood was centrifuged to remove any particulate matter, clots, etc. The blood was then dispensed by means of a syringe system, using Teflon tubing wherever possible to avoid extraneous contamination. Polyethylene bottles were acid-washed, rinsed in distilled water, and dried before being filled with 2 ± 0.2 mL blood. The bottled blood is stored frozen at -20 °C.

Samples were analyzed by thermal ionization stable isotope dilution mass spectrometry (IDMS) and by atomic absorption spectrometry (AAS) using electrothermal atomization. In the IDMS procedure, analyses were performed on weighed samples and the results, in μg/g, converted to μg/dL by using the density of each material.. The densities of the four concentration levels identified by the code letters "A", "B", "C", and "D" are, respectively 1.058, 1.057, 1.055, and 1.056 g/mL at 21.7 °C. Duplicate density determinations agreed within 0.0003 g/mL. Because IDMS is inherently more accurate for the determination of lead in blood than other analytical methods, the certified concentrations are the means of the IDMS results. However, because AAS procedures are more rapid, they were used to determine Pb in a sufficient number of random samples to establish the homogeneity of the entire lot.