

National Bureau of Standards Certificate

Standard Reference Materials

1636, 1637, 1638

Lead in Reference Fuel

This Standard Reference Material is intended for use in the calibration of instruments and techniques used for the analysis of lead in gasoline. Samples of the leaded 91-octane-number reference fuel (See page 2 for composition) are supplied at four concentrations, nominally 0.03, 0.05, 0.07, and 2.0 g/gal. The assigned Standard Reference Material numbers (1636, 1637, 1638) refer to the composition of sets containing the above nominal concentrations in varying combinations. The composition of each set is given in Table 1 on the reverse page.

The certified values for lead content are given in units of $\mu\text{g/g}$. From these certified values the lead concentrations in g/gal and g/l at 20 °C and 25 °C were calculated. These values are given in Table 2.

Nominal Lead Concentration g/gal	Certified Lead Concentration $\mu\text{g/g}$
0.03	12.31 \pm 0.06
0.05	19.68 \pm 0.05
0.07	27.70 \pm 0.06
2.0	772.7 \pm 1.5

The uncertainties cited represent the pooled 95 percent confidence intervals for a single determination with allowances for known sources of possible error. The certified values were determined by isotope dilution mass spectrometry and supported by atomic absorption spectrometry.

The samples of leaded reference fuel should be protected from light. The ampoules should be opened only at time of use. No attempt should be made to keep the material in opened ampoules for future use.

Matrix effects may be observed with various gasolines. Certain adjustments in analytical data may be necessary based on individual knowledge of the magnitude of these effects.

The lead in reference fuel samples were prepared by the Phillips Petroleum Co. of Bartlesville, Oklahoma. Isotope dilution mass spectrometry measurements were performed by T. J. Murphy, N. M. Caliman and E. F. Heald of the Isotopic Analysis Section, I. L. Barnes, Chief. Atomic Absorption Spectroscopy Measurements were performed by R. Mavrodineanu, J. R. Baldwin, and J. L. Weber of the Spectrochemical Analysis Section, O. Menis, Chief.

The technical and support aspects involved in the preparation, certification and issuance of these Standard Reference Materials were coordinated through the Office of Standard Reference Materials by T. W. Mears.

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J. Paul Cali, Chief
Office of Standard Reference Materials

Table 1
Number of ampoules of each concentration contained in
Standard Reference Material 1636, 1637, and 1638

SRM	Nominal Lead Concentration (g/gal)			
	0.03	0.05	0.07	2.0
1636	3	3	3	3
1637	4	4	4	-
1638	-	-	-	12

Table 2
Composition of leaded reference fuels in g/gal and g/l

Nominal g/gal	Lead Concentration ^a			
	g/gal		g/l	
	20 °C ^b	25 °C	20 °C	25 °C
0.03	0.0322	0.0320	0.00851	0.00845
.05	.0515	.0512	.01360	.01352
.07	.0725	.0721	.01915	.01903
2.0	2.024	2.012	.535	.531

^a The lead concentrations given in this table are considered accurate within a coefficient of variation of 0.005.

^b The concentration in g/gal at 20 °C is given in the sample labels.

The concentrations (C) in g/gal were calculated using the equation:

$$C_{\text{g/gal}} = \frac{3785.4 \rho C_{\mu\text{g/g}}}{10^6}$$

The concentrations (C) in g/l were calculated using the equation:

$$C_{\text{g/l}} = \frac{\rho C_{\mu\text{g/g}}}{10^3}$$

The density (ρ) of each concentration was measured at 20 °C and 25 °C using a modification of ASTM Method D1217. The stated interlaboratory reproducibility of this method is 0.00003 g/cm³. Densities of the leaded fuels are given in the following table.

Nominal Concentration g/gal	Density at 20 °C g/cm ³	Density at 25 °C g/cm ³
0.003	0.69126	0.68710
.05	.69127	.68711
.07	.69127	.68711
2.0	.69196	.68774

The 91-octane-number reference fuel is a mixture of 91 percent by volume (0.899 mol-fraction) 2,2,4-trimethylpentane and 9 percent by volume (0.101 mol-fraction) n-heptane. Lead was added in the form of tetramethyllead-tetraethyllead motor mix.