



# National Institute of Standards & Technology

## Certificate

### Standard Reference Material 4400L-N Radioactivity Standard

Radionuclide	Chromium-51
Source identification	4400L-N
Source description	Liquid in NIST borosilicate-glass ampoule <sup>(1)*</sup>
Solution composition	Approximately 29 micrograms of chromium per gram of 1 molar hydrochloric acid <sup>(2)</sup>
Mass	grams
Radioactivity concentration	$4.017 \times 10^6 \text{ Bq g}^{-1}$
Reference time	1700 EST July 28, 1992
Overall uncertainty	0.75 percent <sup>(3)</sup>
Photon-emitting impurities (Activity ratios at reference time)	$^{60}\text{Co}/^{51}\text{Cr}: (3.0 \pm 0.6) \times 10^{-6}$ <sup>(4)</sup> $^{156}\text{Eu}/^{51}\text{Cr}: (1.4 \pm 0.4) \times 10^{-4}$
Half life	$27.702 \pm 0.004 \text{ days}$ <sup>(5)</sup>
Measuring instrument	NIST pressurized "4 $\pi$ " $\gamma$ ionization chamber calibrated by 4 $\pi$ x- $\gamma$ anti-coincidence efficiency-extrapolation technique

This Standard Reference Material was prepared in the Physics Laboratory, Ionizing Radiation Division, Radioactivity Group, Dale D. Hoppes, Group Leader.

Gaithersburg, MD 20899  
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\*Notes on back

NOTES

- (1) Approximately five milliliters of solution. Ampoule specifications:
- |                      |                        |
|----------------------|------------------------|
| body diameter        | 16.5 ± 0.5 mm          |
| wall thickness       | 0.60 ± 0.04 mm         |
| barium content       | less than 2.5 percent  |
| lead oxide content   | less than 0.02 percent |
| other heavy elements | trace quantities       |
- (2) Solution density 1.016 ± 0.002 g/mL at 23.1 °C.
- (2) The overall uncertainty was formed by taking three times the quadratic combination of standard deviations of the mean, or assumed approximations thereof, for the following:
- |   |              |
|---|--------------|
| a) 12 ionization-chamber measurements on this solution  | 0.02 percent |
| b) seven anti-coincidence measurements                  | 0.03 percent |
| c) efficiency extrapolation                             | 0.05 percent |
| d) background   | 0.15 percent |
| e) half life  | 0.01 percent |
| f) gravimetric measurements                             | 0.10 percent |
| g) original ionization-chamber calibration measurements | 0.01 percent |
| h) photon-emitting impurities in original calibration   | 0.03 percent |
| i) correction for L/K branching                         | 0.02 percent |
| j) radium-226 reference sources ratios                  | 0.08 percent |
| k) radium reference source positioning                  | 0.10 percent |
| l) photon-emitting impurities in this solution          | 0.09 percent |
- (4) Limits of detection as a percentage of the gamma-ray-emission rate of the 320-keV gamma rays emitted in the decay of chromium-51 are
- |  |
|--|
| 0.1 percent between 20 and 315 keV     |
| 0.01 percent between 325 and 1900 keV. |
- (5) NCRP Report No. 58, 2nd Edition, February 1985, p. 378.